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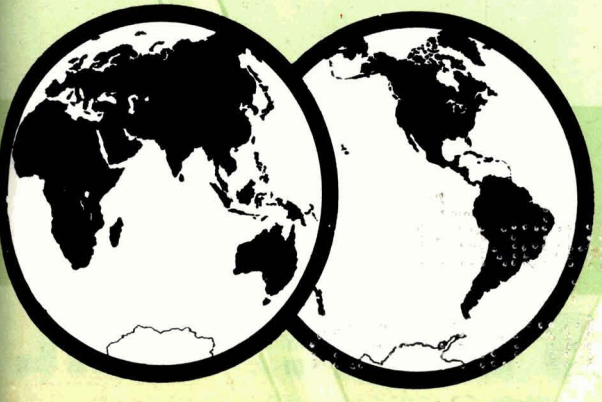

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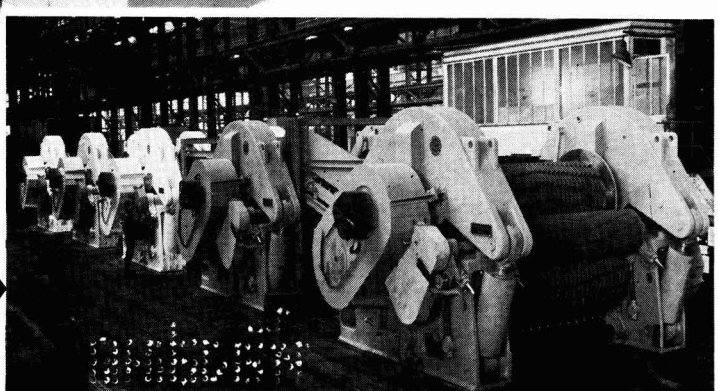

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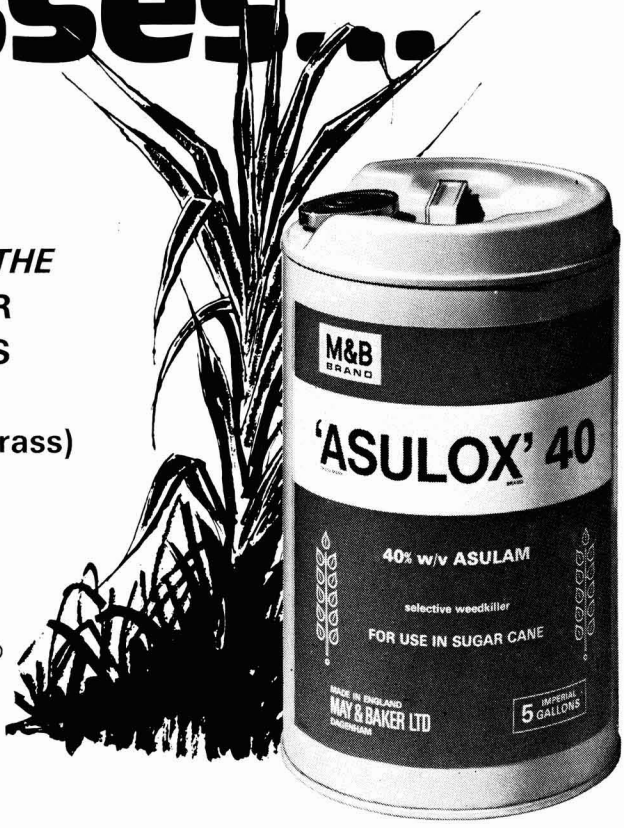

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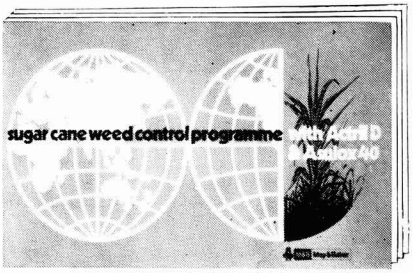

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The data following was first published in the ISSCT in 1971 and is reproduced here to illustrate the effectiveness of the Fabcon I-12 prescription at the Glenwood sugar plant. (Figures are for 1970.)

Period reported	1 year
Chemical dosage (I-12)	4.8 ppm cane weight
EVAPORATOR PERFORMANCE	
Increase in grinding	3.23%
Increase in imbibition	9.32%
Increase in evaporation	2.0 (lb water/hr/ft^2)
EVAPORATOR CLEANING	
Decrease in downtime	36.2%
Increase between cleaning	57.8%
VALUE	
Cost of Fabcon I-12 antiscalant per crop	$3,192
Estimated net savings per crop	$12,459
Estimated net savings per 1000 tons cane	$49.84

Correctly applied Fabcon I-12 never fails to increase evaporator performance and decrease evaporator downtime. And hundreds of sugar factories have used Fabcon I-12 for more than eight years with consistently good results, internationally.

If evaporator scaling is slowing your sugar production down, do as the Glenwood Sugar Co. did, and contact your nearest Fabcon Service Engineer, or representative.

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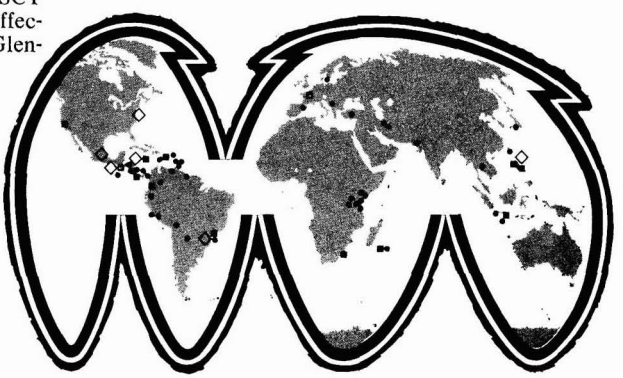

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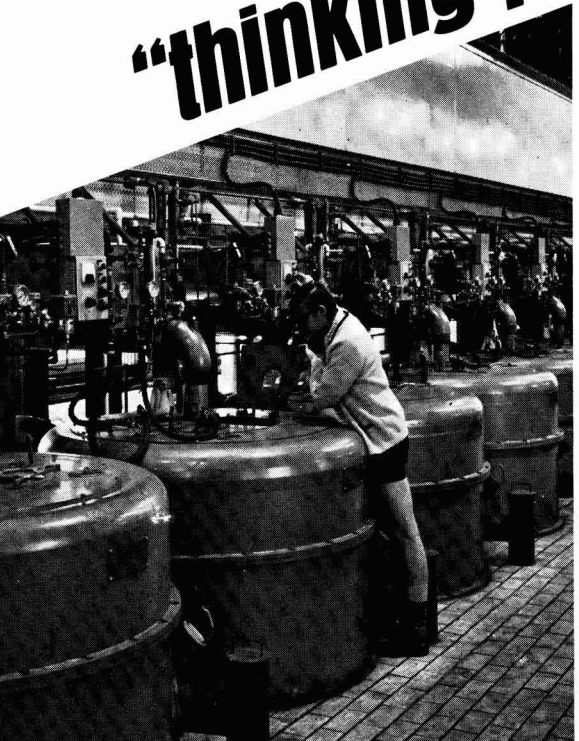

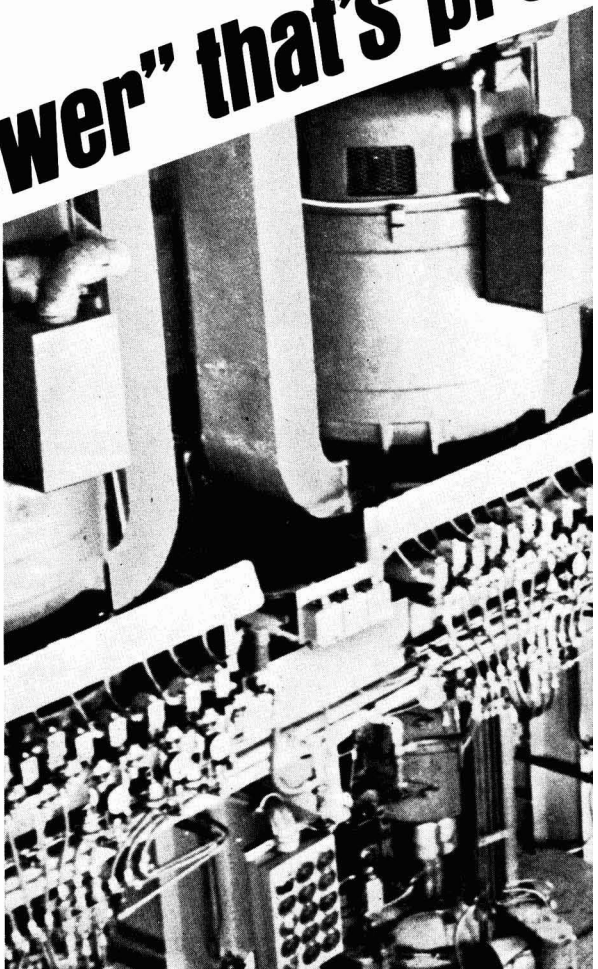

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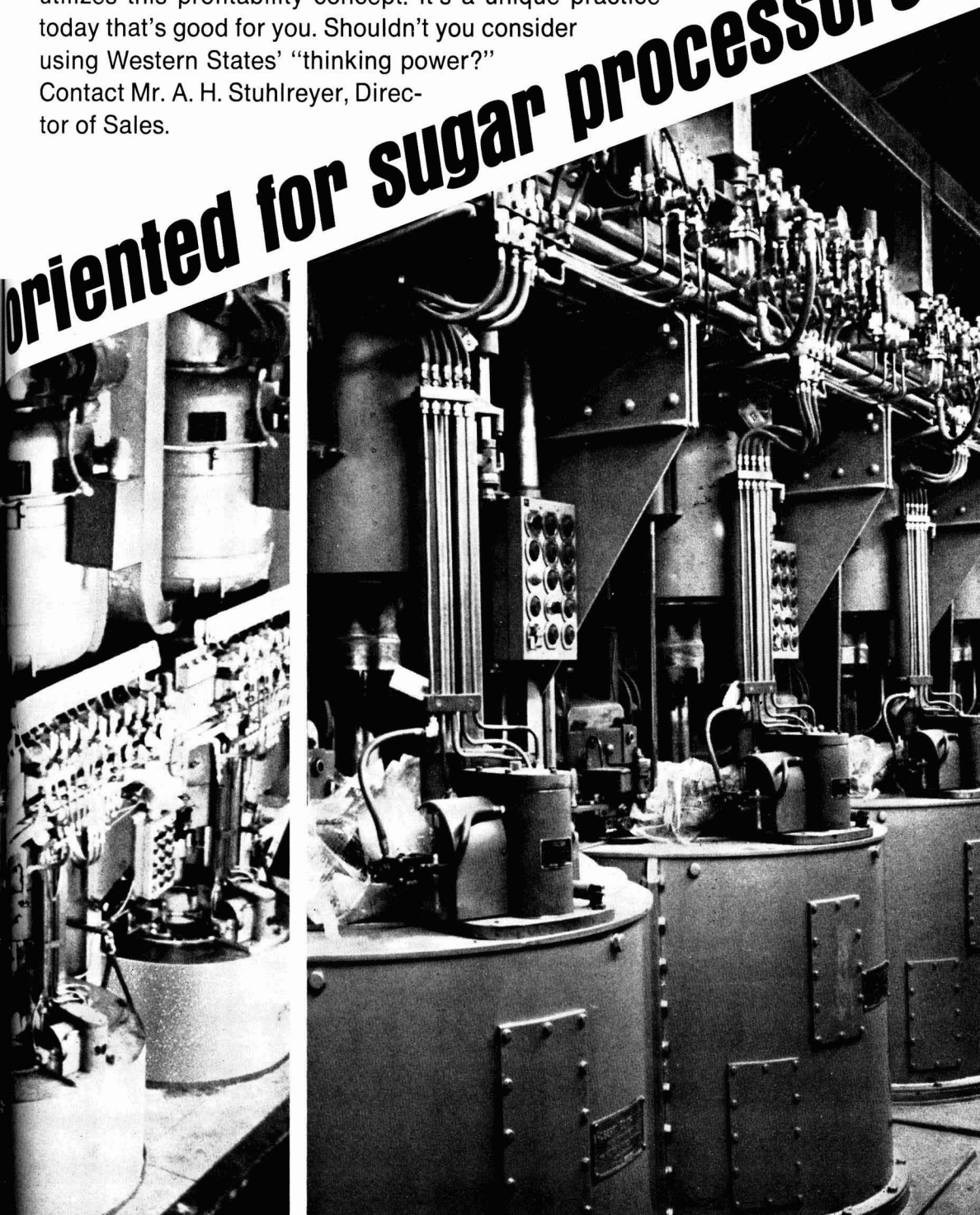

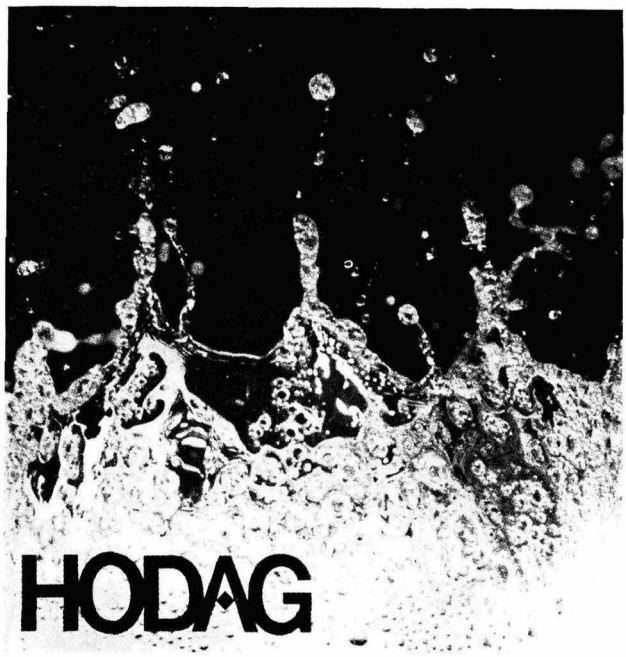

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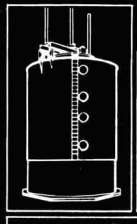

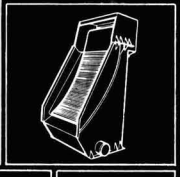

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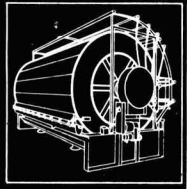

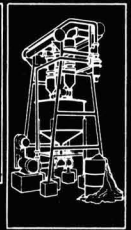

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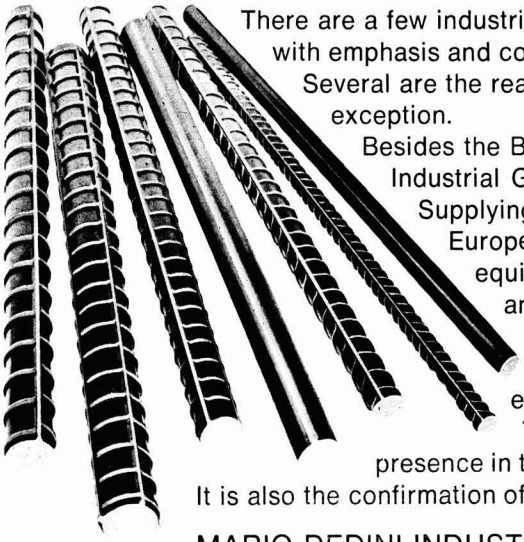

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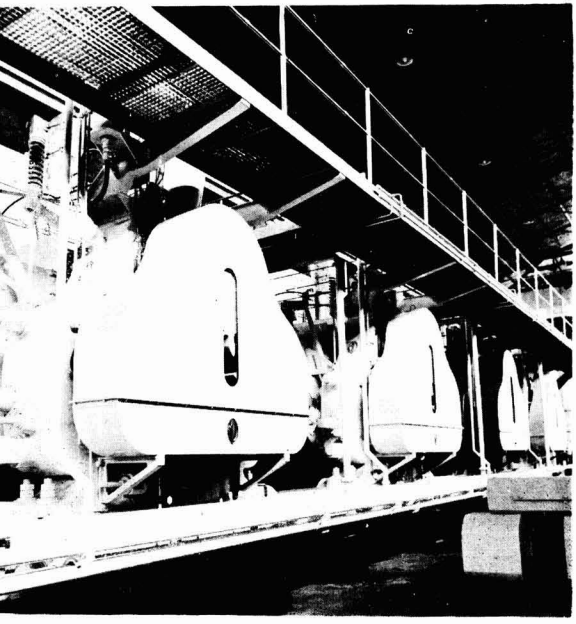

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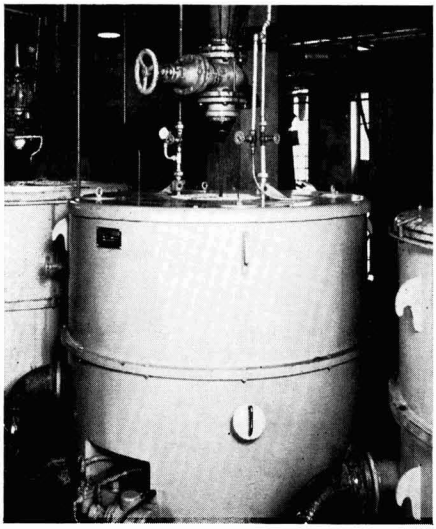

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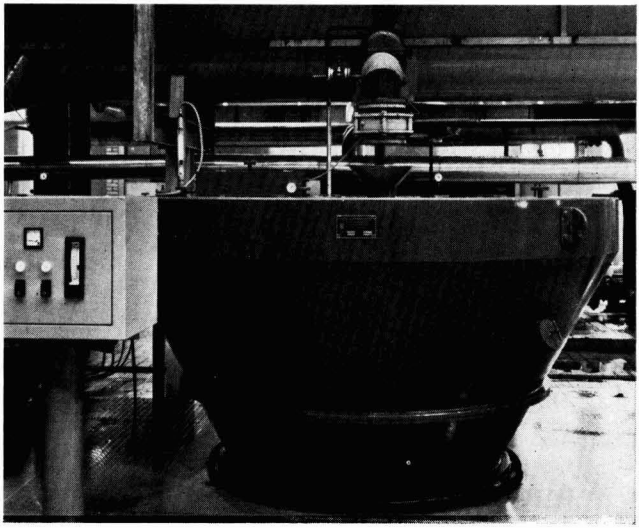

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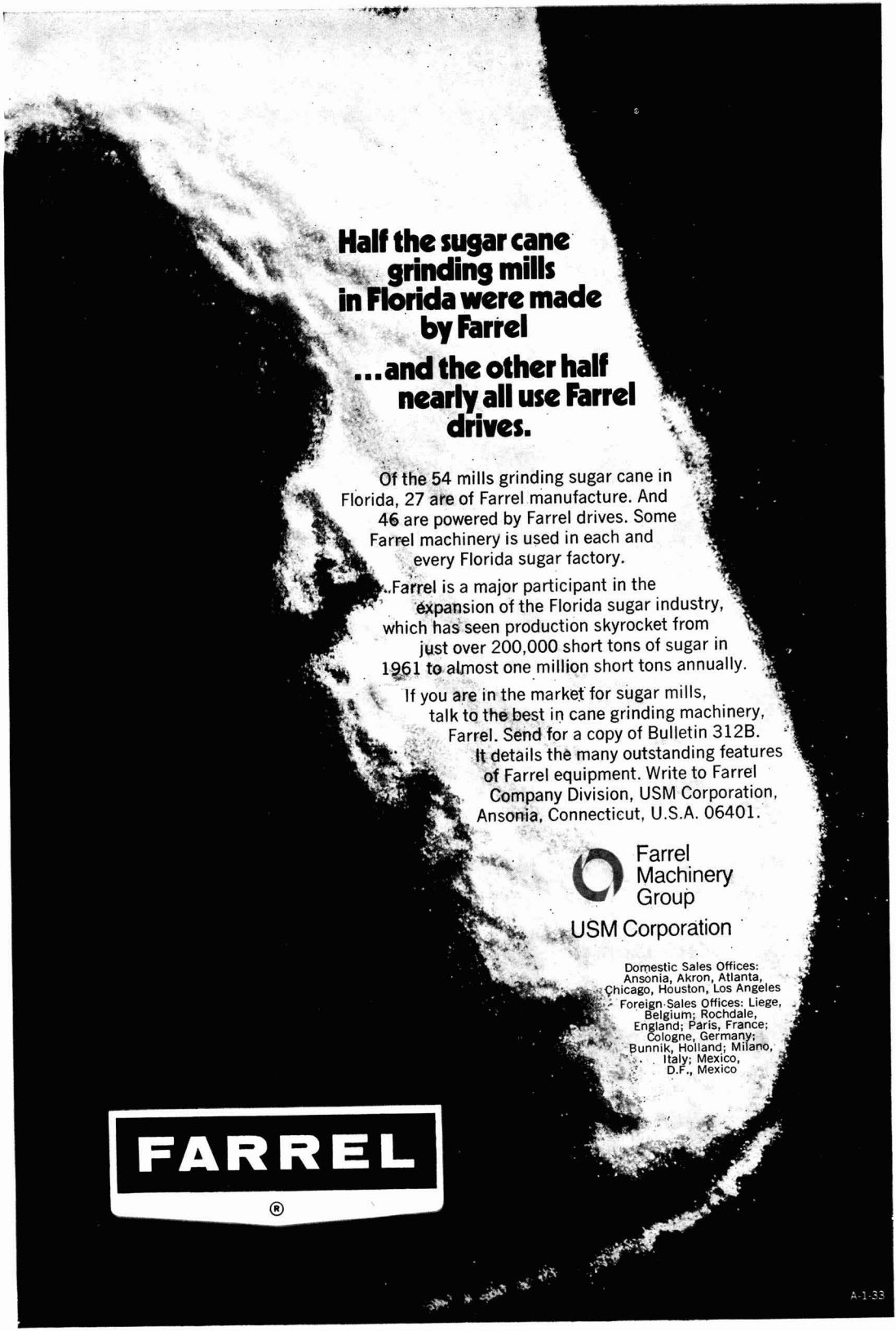
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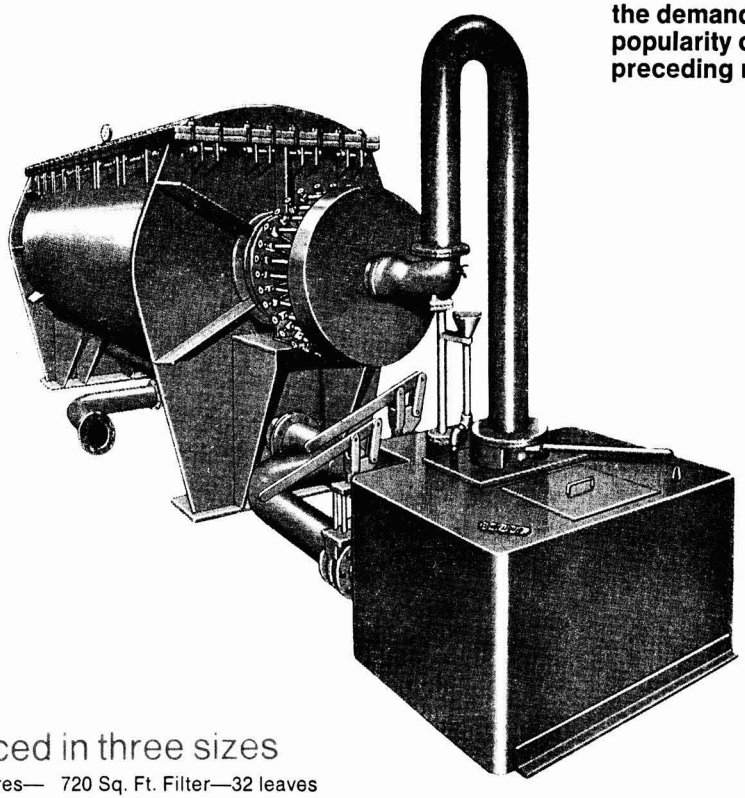

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International Sugar Journal

October 1973

Contents

SOMMAIRES : ZUSAMMENFASSUNGEN : SUMARIOS

Analyse de l'influence de la qualité de la canne à sucre sur le rendement en sucre. 1ère Partie. E. J. BUCHANAN. *p.* 299–303

On a fait une étude statistique aux dépens de données de laboratoire enregistrées dans les usines sud-africaines. Le but poursuivi était d'établir la meilleure corrélation entre la qualité de la canne et le sucre extrahible. On donne des informations au sujet de la procédure d'analyses suivie. On y a analysé les pertes dans les processus individuels et on a déduit des formules qui, pour 1971–72, relient les pertes à la qualité de la canne. La 1ère partie donne des détails sur la perte aux moulins et dans les mélasses. Les pertes sont exprimées de différentes façons.

* * *

La mécanisation de la canne dans les Antilles britaniques. ANON. *p.* 304–306

On résume la situation dans le Barbados, Guyana, Jamaïque, St. Kitts et Trinidad au point de vue récolte et chargement mécanique de la canne. On fait état des problèmes rencontrés et des types d'équipement qui sont soit régulièrement utilisés ou essayés.

* * *

Extraction dans un moulin à canne. La relation entre l'extraction du jus, l'indice de ligneux, la pression en tête et la vitesse circonférentielle du rouleau. A. T. DE BOER. *p.* 306–308

La relation mentionée ci-dessus est examinées et, aux dépens des données d'usine, on calcule les valeurs de *N* (une variable qui est fonction de la vitesse circonférentielle du rouleau). Ces données sont reliées à la vitesse circonférentielle des rouleaux et on cite des graphiques montrant la liaison pour le ler ou le 2ème rouleau, ainsi que pour les suivants.

* * *

Une comparaison de la carbonatation et la décoloration par sulfitation dans les sirops de sucre brut. F. H. C. KELLY, F. K. MAK et K. C. LOO. *p.* 308–310

On examine les effets du pH et de la quantité de chaux sur la décoloration du sirop de sucre brut par carbonatation ou par sulfitation effectuées à température et concentration constantes. On détermine les conditions optimales.

Eine Untersuchung über den Einfluss der Qualität des Zuckerrohrs auf die erreichbare Zuckerausbeute. Teil I. E. J. BUCHANAN. *S.* 299–303

Der Autor hat die Labordaten aus den südafrikanischen Zuckerfabriken statistisch untersucht, um die beste Beziehung zwischen der Qualität des Zuckerrohrs und der erreichbaren Zuckerausbeute zu ermitteln. Er informiert über die grundlegenden Analysenverfahren, nach denen die Verluste in den einzelnen Verfahrensschritten bestimmt werden, und leitet für 1971/72 Formeln über die Beziehung zwischen Verlusten und Rohrqualität ab. In Teil I der Arbeit sind Einzelheiten über die Verluste in den Rohrmühlen und in der Melasse mit wichtigen Formeln angegeben, welche die Verluste in verschiedener Form ausdrücken.

* * *

Mechanisierung der Zuckerrohrernte in Westindien. ANON. *S.* 304–306

Es wird ein zusammenfassender Ueberblick über die Situation in Barbados, Guayana, Jamaika, St. Kitts und Trinidad hinsichtlich der Mechanisierung von Zuckerrohrernte une -transport gegeben. Dabei werden die vorhandenen Probleme behandelt und die in regelmässigem Einsatz oder in der Prüfung befindlichen Maschinentypen besprochen.

* * *

Rohrextraktion in einer Mühle. Die Beziehung zwischen Saftextraktion, Fiber-Index, Druck der oberen Walze und Umfangsgeschwindigkeit der Walzen. A. T. DE BOER. *S.* 306–308

Die in der Ueberschrift angegebene Beziehung wurde untersucht. Aus den Fabrikdaten wurden Werte für *N* (einer von der Umfangsgeschwindigkeit der Walzen abhängigen Variablen) errechnet, die zur Umfangsgeschwindigkeit der Walzen in Beziehung gesetzt wurden. Die Beziehung für die erste, die zweite und die folgenden Mühlen sind in Diagrammen wiedergegeben.

* * *

Vergleichende Untersuchung über die Entfärbung von Rohzuckersirupen durch Carbonatation und Sulfitation. F. H. C. KELLY, F. K. MAK und K. C. LOO. *S.* 308–310

Der Einfluss von pH-Wert und Kalkmenge auf den Grad der Entfärbung von Rohzuckersirupen durch Carbonatation oder Sulfitation bei konstanter Temperatur und Sirupkonzentration wurde untersucht. Die optimalen Bedingungen wurden angegeben.

Un análisis de la influencia de la calidad de caña de azúcar sobre la recuperación de azúcar. Parte I. E. J. BUCHANAN. *Pág.* 299–303

Un investigación estatística se hizo de dados de los laboratorios de fábricas azucareras de Sud-Africa con el fín de establecer la mejor relación entre calidad de caña y azúcar recuperable. Se presentan información sobre los procedimientos básicos que se han adoptado, que permitieron análisis de pérdidas en los procesos individuales, y fórmulas derivado de las resultas de 1971–72 que relacionan las pérdidas a la calidad de caña. En este primer parte se presentan detalles de las pérdidas en molienda y en melaza con fórmulas relevantes; estas expresan las pérdidas en varias formas.

* * *

Mecanización del campo en las Antillas. ANON. *Pág.* 304–306

Se presenta un sumario de la situación en las Barbadas, Guayana, Jamaica, St. Kitts y la Trinidad respecto de la mecanización de cosecha y alzamiento de caña, con mención de las problemas y los tipos de equipo que estan en uso regular o que se prueban.

* * *

Extracción de un molino de caña. La relación entre extracción de jugo, indice de fibra, presión de arriba, y velocidad circunferencia de la maza. A. T. DE BOER. *Pág.* 306–308

La relación del título se examina y valores de *N* (un variable que depende sobre la velocidad circunferencial de la maza) se calculan de dados de una fábrica. Estos se relatan a las velocidades circunferenciales de la mazas, y se construyen gráficas de la relación para el primer, el segundo y otros molinos detrás.

* * *

Una comparación entre carbonatación y sulfitación para descolorización de licores de azúcar crudo. F. H. C. KELLY, F. K. MAK y K. C. LOO. *Pág.* 308–310

Se examinan los efectos de pH y la cantidad de cal sobre el grado de descolorización de licor de azúcar crudo por carbonatación o sulfitación a temperatura constante y concentración constante del licor, y se determinan condiciones óptimas.

THE

INTERNATIONAL SUGAR JOURNAL

VOL. LXXV OCTOBER 1973 No. 898

Notes & Comments

International Sugar Conference

Meetings, described as helpful, were held in early August between the Chairman of the first session of the International Sugar Conference, Mr. ERNEST JONES-PARRY, and representatives of about ten of the major importers and exporters.

The second session of the Conference was scheduled to begin on the 10th September and to continue for a month. It is to be hoped that as many countries as possible will adhere to a text which will be satisfactory to all parties and which will provide the stability which is essential to the well-being of all the producers and consumers of our commodity. Given the goodwill apparent during the first session of the Conference it seems likely that a new Agreement can be produced.

* * *

World raw sugar price

During August the London Daily Price fluctuated between £89.00 and £99.00 per long ton, while the market was busy and much sugar was traded. The changes have been the result of a number of causes, including two important factors; the first of these is the recent disturbances in currency levels and exchange rates which have encouraged speculation in commodities, while the second is the desire on the part of exporters to dispose of as much sugar as possible during 1973 as establishment of an exporting performance record for negotiation purposes during the International Sugar Conference and also to avoid having sugar on hand in case quotas should return in 1974. The first factor, coupled with the weakening of the US dollar and the pound sterling, has tended to raise prices while the second has tended to lower them; hence the fluctuation.

* * *

European beet sugar prospects

Beet tests have been published by a number of West European countries, the earliest at the beginning of August, and the likely kind of results are emerging. Root weights are higher than last year, except in France and West Germany, and in all countries the sugar content is higher. Thus the crop is probably going to be better than average although results do not indicate so good a crop as in the excellent 1971 season. Where the areas planted to beet have been increased this will also contribute to higher crops which should be records in some areas.

* * *

UK sugar industry structure

The British Government, British Sugar Corporation and Tate & Lyle Ltd. have been engaged in negotiations concerning the future structure of the sugar industry in the UK. This arises out of the fact that, with membership of the European Economic Community, the UK becomes subject to the Common Agricultural Policy although, during negotiations for EEC membership, it was agreed that sugar supplies from the Commonwealth were a special case and that, after termination of the Commonwealth Sugar Agreement in 1974, arrangements would be made which would have as their firm purpose to safeguard the interests of the developing countries of the Commonwealth whose economies depended to a considerable extent on this commodity and other primary products.

Australia, as a developed country, is not considered in need of such protection and supplies from this source—about 400,000 tons/year—are to be phased out after 1974. This means that the sugar refining industry will shrink by this amount while it is anticipated that the beet sugar sector will expand to meet increases in consumption in the UK. As a matter of equity, the refiners have asked for compensatory measures and it has been suggested that they should acquire the Government shareholding in the British Sugar Corporation since it was not economically practical to enter anew into beet sugar manufacture.

This proposal was rejected by the Corporation since it would involve the shareholders of B.S.C. compensating the shareholders of the refining companies and this is not considered to be a proper responsibility. The Corporation has submitted other proposals which would produce a unified sugar industry and provide a practical means of refining up to 1·4 million tons of sugar from the developing Commonwealth without the need for subvention payments. Details have not been disclosed but it is

reported[1] that the main feature would be the refining of raw sugar by the Corporation during the off-season at low cost. What function Tate & Lyle Ltd. and the other refiners would play is not clear, nor has their reaction to the proposals been published, and the confidential discussions continue.

* * *

UK beet sugar crop, 1972/73

In 1972 the season started well and crops were sown comparatively early in most areas but the generally cool, dry summer weather and unfavourable conditions in June and July resulted in a lower than average crop. The total quantity of beet delivered to the factories of the British Sugar Corporation Ltd. was 6,117,959 tons, equal to 13·82 tons per acre, compared with 7,744,941 tons the previous year when there was a near record yield of 17·33 tons per acre. The smaller crop was partly compensated for by a high average sugar content of 17·04% as against 16·56% for 1971/72 and the higher percentage of sugar extraction achieved in 1972/73. The whole of the crop was delivered to the factories in excellent condition. The average daily beet slice of 59,018 tons was below the record of the previous year of 62,747 tons, mainly owing to the higher sugar content of the beet, but partly as a result of a major breakdown in a new boiler at Peterborough factory which severely reduced the factory's productive capacity. The new Wissington factory, which had experienced some initial difficulties the year before, ran well and achieved an all-time record slice for a white sugar plant in the UK of 6,300 tons of beet per day.

As a result of the smaller crop, production of sugar and by-products was below the record levels of the previous year. Sugar output, in terms of white sugar, was 872,475 tons as against 1,069,151 tons.

* * *

US sugar supply quota, 1973

On the 23rd August the US Dept. of Agriculture announced shortfalls of 45,000 short tons, raw value, against the quota for Puerto Rico and 34,464 tons against that of Venezuela. Of the total, 18,807 tons were awarded to the Philippines and the remainder divided among Western Hemisphere producers as follows: Dominican Republic 13,851 tons; Mexico 12,250 tons; Brazil 11,946 tons; Peru 8549 tons; Panama 2500 tons; Ecuador 1763 tons; Argentina 1656 tons; Costa Rica 1569 tons; Colombia 1472 tons; Nicaragua 1467 tons; Guatemala 1342 tons; El Salvador 979 tons; Belize 736 tons; Haiti 295 tons and Bolivia and Paraguay 141 tons each. After the announcement, the Department was notified that Peru was not able to take up her share of the reallocation so that a further reallocation may be expected although this has not been announced at the time of writing.

* * *

USSR sugar beet crop prospects

An appeal has been published in the newspaper *Pravda* by the Central Committee of the Communist Party as well as the Soviet Government for workers to make all efforts to bring in the "record 1973 sugar beet crop". If necessary drivers from all enterprises will be mobilized to avoid losses resulting from over-long storage of sugar beets in the fields; such losses helped to reduce the 1972/73 crop as a result of inadequate transport arrangements.

Crop prospects are considered good and an increase of 1·9 million tons of sugar is mentioned; unfortunately it is not indicated whether this is an estimated increase over the 1972/73 crop or a figure calculated on plan data. The latter provide for sugar beet purchases of 82·6 million tons and a sugar production of 10,056,000 tons. Which figure is intended is of importance, as may be seen from the fact that, while the plan called for sugar beet purchases of 80,400,000 tons and sugar production of 8,956,000 tons in 1972, actual figures were 67,700,000 and 7,235,000 tons, respectively. Thus the plan calls for an increase of 1·1 million tons between 1972 and 1973 unless the figures have been revised.

A further complication is that the calendar year plan figures do not relate directly to campaigns since the latter extend into the new years. As a consequence the *Pravda* report does not permit more accurate estimation of the likely crop in the USSR. F. O. Licht K.G., discussing the crop, write[2]: "We are therefore of the opinion that the poor results obtained in recent years were less due to unsatisfactory beet growth and more to bad organization of the harvesting operations, of transport and of beet processing in the factories.... Owing to this year's beet development as well as to the extended beet acreage, the sugar beet crop may exceed last year's crop and there may also be an increase of sugar production, provided that storage, transport and processing of beets goes well and that no losses arise. This seems to be the weak point this year, because *Pravda* has already pointed out technical difficulties on many farms during the period of the harvest as well as to the fact that several sugar factories are still insufficiently prepared for beet processing".

* * *

UK beet area, 1974

British farmers will be able to grow an extra 20,000 acres of sugar beet next year. This is the outcome of an agreement between the British Sugar Corporation and the National Farmers Union of the UK. The total area under sugar beet in 1974 will be 488,000 acres, an all-time record. The 1971/72 acreage was 443,000 and yielded 7·7 million tons of beet while the same area produced only 6·1 million tons of beet in 1972/73.

The area under beet was raised to 468,000 acres in 1973 and the crop is expected to be well above average.

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[1] *The Times*, 17th July 1973.
[2] *International Sugar Rpt.*, 1973, **105**, (23), 1–2.

An analysis of the influence of sugar cane quality on sugar recovery

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Paper presented to the 40th Conference, Asociación de Técnicos Azucareros de Cuba, 1972

PART I

Introduction

THE influence of cane quality on sugar recovered from cane and the distribution of pol losses is of considerable importance both in the planning and administration of a sugar industry. In many countries recoverable sugar in cane forms the basis of the distribution of proceeds among growers delivering cane to the factories. In addition, the selection of cane varieties, the height at which cane should be topped, the length of the milling season, comparison of factory efficiencies and other aspects of industrial organization all require a knowledge of the amount of sugar which can be recovered from cane of varying quality if optimum conditions are to be achieved. Apart from the sucrose content, the amount and nature of the fibre and soluble impurities in cane are generally accepted to influence sugar recovery. For this reason, while an approximate estimate of recoverable sugar may be made from pol in cane alone, a precise estimate can be made only on the basis of a thorough analysis of the raw material. The exact influence of these properties of cane is still a subject of some conjecture as numerous publications illustrate. Furthermore, there is little international uniformity in the choice of performance parameters to express the specific efficiency of unit operations in sugar processing in isolation of the influence from cane quality.

In recent years, technologists in South Africa have devoted considerable attention to the sampling and analysis of cane and the calculation of recoverable sugar from the cane analysis. A system for direct sampling of cane by means of an automatic fall-out hatch situated between the cane shredder and the first mill was developed by the Sugar Milling Research Institute[1]. A system of direct cane analysis was also developed. This involves fine preparation of the cane followed by high-speed extraction with cold water to determine pol and Brix on the decanted extract. The Brix is determined by precision refractometer while an automatic saccharimeter is used for polarization. The fibre is determined by means of a moisture determination using the Brix. The implementation of this system at all twenty sugar factories is nearing completion. All factories are being equipped with sufficient apparatus to enable every delivery of cane to be tested and this amounts to some six to ten tests per hour at most factories. Identification of cane deliveries to the sampling point is facilitated by means of an electronic tracking device. The direct cane analyses at each factory are adjusted weekly to comply with the average cane analysis based on the mixed juice and bagasse. Steps have been taken to ensure that these are assessed with the greatest possible accuracy. The introduction of direct analysis of bagasse, the use of the high-speed extractor for pol and Brix analysis and the correction of errors in juice analysis due to suspended matter are further examples of improvements recently implemented.

With the assurance of a high degree of precision in the analysis of cane, attention has now been devoted to developing an accurate means of calculating recoverable sugar in cane from the analysis. For this purpose recoverable sugar is defined as the amount of standard sugar which can be recovered from cane assuming it is processed at the average efficiency of the industry. The subject has been under discussion for some time by a committee of technologists. After a number of conflicting proposals had been advanced it was agreed that a thorough statistical investigation should be conducted in order to find the best relation-

Bx = Brix
C = filter cake
E = extraction, %
F = fibre
I = imbibition
M = molasses
N = non-pol (or non-sucrose)
P = purity
R = reducing sugar
S = sucrose (or pol)
S' = sucrose predicted by calculation
W = water
Y = year number

Subscripts:

b = bagasse
c = cane
clj = clarified juice
e = extracted
f = filter cake
fej = first expressed juice
j = cane juice
m = molasses
mj = mixed juice
n = non-sucrose
p = pol
r = recovered
u = undetermined

(Note that the second subscript refers to percentage, e.g. S_{be} refers to sucrose in bagasse % cane)

Correlation data:

R = multiple correlation coefficient
r = simple correlation coefficient
$S.E.$ = standard error
$N.S.$ = non-significant
* = level of significance: * 5%, ** 1%, *** 0·1%

[1] BUCHANAN: *Proc. 13th Congr. I.S.S.C.T.*, 1968, 1827–1841.

ship between cane quality and recoverable sugar, and a choice between conflicting technological hypotheses. This paper outlines the results of this investigation and illustrates the development of the formula for calculating recoverable sugar in cane using typical results.

Basic Procedures of Analysis

The data used in the investigation were obtained from monthly and annual summaries of factory laboratory data as published by the Sugar Milling Research Institute and the *Proceedings* of the South African Sugar Technologists' Association. Sampling and analytical procedures are strictly standardized throughout the industry and this applies to output as well as input streams.

Random errors due to sampling and analysis as well as in stocktaking are eliminated to some extent by the use of monthly data but changes in throughput and efficiency as well as mode of operation in the factories inevitably complicate statistical correlation. By using a computer, the rapidity with which regression analysis could be conducted made it possible to process a considerable amount of data from each individual factory. It was also possible to repeat correlations rapidly if low correlation coefficients were obtained omitting either the first or last months when abnormal results were indicated by the analysis. These would logically be attributed to start-up and boiling-off operations.

The computer was programmed to recalculate basic data in the form required for analysis. Programmes were also prepared to facilitate two- and three-variable linear regression analysis with a high degree of precision.

The relatively small range of most cane quality variables presents a problem in relating cane quality to losses and obtaining significant levels of correlation. For this reason it was found essential to design the analyses along the most specific lines possible and to analyse individual operations in the process rather than the overall recovery. The losses of sucrose in bagasse, filter cake and molasses and undetermined losses were all analysed individually in the first instance to determine the most appropriate method of relating them to cane quality aspects. Inevitably some factories provided data which on the monthly basis during one season failed to provide significant levels of correlation. Discussions with the staff at these factories generally revealed that changes had been made to equipment during the season. A typical example of this is Hulett's Sugar Ltd. at Amatikulu which showed the following relationship on monthly data for 1971–72 between sucrose lost in bagasse % cane and fibre % cane in association with concentration of cane juice:

$$S_{bc} = -0{\cdot}0510F - 0{\cdot}0261Bx_j + 1{\cdot}7499 \qquad R = 0{\cdot}6415 \quad \ldots\ldots\ldots\ldots (1)$$

Discussions with the factory staff revealed that progressive improvements had been made in the milling efficiency including the installation of heavier hammers in the shredder and that these had masked the influence of the increase in fibre content of cane during the maturing period. In addition the range in fibre % cane was abnormally small. In all analyses the 5% level of significance was taken as the minimum. The latter analysis in equation (1) failed to satisfy this requirement.

In the first instance, a simple recovery formula (proposed previously) was investigated. This was of the form:

$$S'_r = aS - bN - cF \quad \ldots\ldots \qquad \ldots\ldots\ldots\ldots (2)$$

in which recoverable sugar % cane was estimated from the pol, non-pol and fibre % cane. The factors against these variables were obtained on the basis of average industrial results during a representative period. The factor against pol (*a*) represents a deduction of the combined filter cake and undetermined losses expressed as a fraction of the sucrose % cane. The factor (*b*) represents the loss of pol in bagasse as a fraction of the fibre in cane and (*c*) expresses the loss in molasses as a fraction of the non-pol in cane. Using the annual industrial average data for 1960 to 1971–72 this equation becomes:

$$S'_r = 0{\cdot}9805S - 0{\cdot}4547N - 0{\cdot}0491F \quad \ldots\ldots\ldots (3)$$

The danger of applying a plausible formula of this type which is not statistically based was soon revealed by a preliminary analysis showing that it was closely approximated by:

$$S'_r = S - 2 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

for cane within the normal quality range indicating that there was little advantage in practice over applying a fixed sucrose recovery for the production of recoverable sugar. Over a wider range of cane quality the influence of the nature of the fibre and non-pol could also become significant and this is omitted in equation (3). A method of accounting for both the quantity and nature of the constituents of cane was therefore investigated. This forms the basis of the statistical analyses which follow.

Statistical Evaluation of the Milling Loss

Alternative expressions

The prediction of pol loss in bagasse as a percentage of cane (S_{bc}) has been based on cF or cB_jF, i.e. fibre alone or something similar to lost cane juice:fibre as the criterion. While published comments acknowledge the influence of both elements on milling performance, there is little quantitative agreement and little attempt to examine the data statistically. Follett-Smith[2] and Webre[3] have provided operating data to indicate that the loss during milling is less dependent on cane juice concentration than fibre and that the most appropriate expression of milling efficiency lies somewhere between the two extremes of lost juice:fibre and lost pol:fibre. This is supported by Hugot[4] who postulates that the influence of pol % cane on milling loss is restricted to the Nth root of pol % cane

[2] *I.S.J.*, 1969, **71**, 138–140.
[3] *Proc. 13th Congr. I.S.S.C.T.*, 1968, 1595–1599.
[4] "Handbook for Cane Sugar Engineering", 2nd edn. (Elsevier, Amsterdam) 1972, p. 317.

where N is the number of milling units in the tandem. SHAW[5] has also shown that the influence of cane quality on extraction decreases with an increase in the number of mills and imbibition rate.

Theoretical technological appraisal

A change in water content in cane over normal ranges is unlikely to have a marked influence on the juice:fibre ratio of first bagasse since an increase in juice in cane is compensated by a reduction in fibre depth and juice viscosity both of which tend to facilitate an increase in percolation for the same pressure drop. In fact the softer fibred canes should prepare better and this could facilitate improved juice extraction. If this is correct then the juice:fibre ratio in first bagasse would be reasonably consistent and the pol:fibre ratio in first bagasse would be proportionate to the juice concentration assuming homogeneous juice. It is known, however, that as pressure increases, the concentration of progressively extracted juice decreases. As the cane progresses through the milling tandem, the relationship between the average juice concentration and the residual juice concentration becomes increasingly obscure. The fibre, however, is transported quantitatively through the whole tandem. The validity of placing the same emphasis on cane juice concentration as on fibre in determining loss of pol in bagasse is therefore questionable. Calculations for the design of countercurrent multistage leaching plant indicate that the concentration of the solution in the discharge solids (underflow) has a logarithmic relation to that in the feed and the number of stages[6].

Original justification for lost undiluted juice % fibre

The term lost undiluted juice % fibre has gained acceptance in several countries as a measure of milling performance and this assumes the same influence of fibre and juice concentration on loss of pol in bagasse. The term was invented in Java prior to publication in 1929 by SIJLMANS[7]. His justification for its use was that "in Java it has been accepted as a fact for many years that pol in bagasse % fibre is not a good basis for mutual comparison because of its dependence on pol % cane". He then presented a table showing factories grouped in classes of pol % cane which gave some evidence to support his contention. Significantly, the mills on which the analysis was based were all equipped with a crusher and only four mills and the milling loss ranged from 5·5 to over 6% pol in bagasse on fibre. In South Africa, the milling trains are longer and the milling loss averages about 3·6%. In addition, the imbibition rates are high, which according to WEBRE would reduce the influence of the cane juice concentration. The information quoted by SILJMANS as the basis for lost undiluted juice % fibre is not statistically significant and suggests a very small influence of pol % cane on milling loss (a change of 12 to 15 pol % cane changes the milling loss from 5·4 to 6·0). In fact from these data it appears that the pol lost in bagasse % cane may be expressed as:

$$S_{bc} = 0{\cdot}06\,F + 0{\cdot}03\,Bx_j$$

It is also clear from his data that the influence of pol in cane on milling loss decreases with longer milling trains.

Statistical examination of local data

One difficulty in the examination of South African data is that the milling efficiency has increased tremendously from season to season to the extent that it is impossible to obtain significant correlations using annual data. This reduces the annual data of statistical value to such a small number of observations that no correlation is possible. Correlations have therefore been restricted to analyses of monthly data within one season. Even so, as mentioned above, changes to milling plant are sometimes made during the season and this reduces the level of correlation between milling loss and cane quality. One problem which experience has revealed in this approach is that low concentration of cane juice is characteristic for the beginning and the end of the season. At the beginning of the season, milling efficiency is usually impaired by adjustment of settings and low time efficiency while at the end of the season equipment is worn and climate is less conducive to efficient milling. These difficulties are pinpointed by a low correlation coefficient and this is usually improved by omitting the first or last month.

A large number of annual data for individual factories has been analysed month by month and in many instances significant correlations have been obtained relating the loss of sucrose in bagasse to the fibre in cane and concentration of cane juice. Some typical results are given below:

$$S_{bc} = 0{\cdot}0367F + 0{\cdot}0135Bx_j - 0{\cdot}273 \quad R = 0{\cdot}879^{**} \tag{5}$$

$$S_{bc} = 0{\cdot}0410F + 0{\cdot}0274Bx_j - 0{\cdot}542 \quad R = 0{\cdot}771^{**} \tag{6}$$

$$S_{bc} = 0{\cdot}0373F + 0{\cdot}0176Bx_j - 0{\cdot}435 \quad R = 0{\cdot}976^{**} \tag{7}$$

$$S_{bc} = 0{\cdot}0419F + 0{\cdot}0201Bx_j - 0{\cdot}382 \quad R = 0{\cdot}974^{**} \tag{8}$$

The above examples refer to the monthly data for 1971–72 and equation (5) represents the industry, while (6), (7) and (8) are for Malelane, Darnall and Felixton respectively. In other cases lower levels of correlation have been obtained but in every instance the coefficient against the Brix of cane juice is about half or less than half that of the coefficient against fibre.

In several instances the coefficients against both variables appear inflated but this can be shown to be due to a fortuitous increase in milling loss accompany-

[5] *Proc. 14th Congr. I.S.S.C.T.*, 1971, 1342–1359.
[6] MCCABE and SMITH: "Unit Operations of Chemical Engineering", (McGraw-Hill, New York) 1956, p. 761.
[7] *Proc. 3rd Congr. I.S.S.C.T.*, 1929, 533–550.

ing the increase in fibre in cane at the maturing period. A good example of this is Gledhow:

$$S_{bc} = 0{\cdot}1899F + 0{\cdot}0641Bx_j - 3{\cdot}5925 \quad R = 0{\cdot}881^{**} \tag{9}$$

The levels of the factors are obviously suspect and examination of the process data indicated marked changes in imbibition/fibre ratio from 2·59 to as low as 2·17 accompanying the maturing of cane. Further statistical analysis of this along the lines proposed by WEBRE[3] show that part of the variance in milling loss was attributable to the variation in imbibition level:

$$S_{bc}/F = 0{\cdot}0956S/W - 0{\cdot}0386I/F + 0{\cdot}1034 \quad R = 0{\cdot}810^{*} \ldots\ldots (10)$$

An examination of the above coefficients in equation (10) indicates that correction for the influence of imbibition would resolve the coefficients in equation (9) to the level of those in the preceding equations. It is interesting to note that the influence of changes in the pol:water ratio in cane juice is greater than changes in the imbibition:fibre ratio. However, since the former is likely to change by only 0·01 or so while the latter may change by the order of 0·1, the influence of imbibition changes is more likely to effect a noticeable change in milling loss than is a change in pol:water in cane.

Expression of milling loss

In spite of being able to prove statistical dependence of pol loss in bagasse on fibre in cane and cane juice concentration, numerous analyses show that it is not possible to account for more than 80% of the variance in loss with the exception of a few cases. This conclusion must be appraised in the light of obvious variation in milling performance due to inconsistent imbibition rates and crushing rates. Furthermore, changes to equipment and mill settings as well as maintenance on the run must logically account for some of the residual variance. Another undoubtedly important factor is changes in other properties of cane which influence milling efficiency and which have not been taken into account. This would include such factors as Brix distribution within the cane and other physical properties such as the hardness of the fibre and its influence on preparation and milling. The feasibility of being able to distinguish between these two aspects of residual variance is remote.

Notwithstanding the above limitations there is evidence to show that the influence of juice concentration on pol loss in bagasse is smaller than that of fibre and relatively low correlation levels in a number of cases indicate that other factors in cane quality and/or variation in milling efficiency can have a very significant influence on the loss. Under these circumstances the prediction of milling loss by means of a purely statistical formula may be questionable and it is suggested that the principles indicated by statistics may be used as a basis for formulating an empirical solution to the problem. These are that significant correlations can be found between the fibre in cane and loss of pol in bagasse and that the concentration of cane juice has a smaller influence. The latter seems likely to be about half that of the fibre and of the order of $0{\cdot}02Bx$.

It is suggested that the sugar loss in bagasse be predicted by a formula such as:

$$S_{bc} = cF + 0{\cdot}02Bx - C \quad \ldots\ldots\ldots\ldots\ldots (11)$$

where c = factor derived from S_{bc}/F average for the industry

C = constant equal to $0{\cdot}02Bx_j$ average for the industry.

This expression offers a simple compromise between the two extremes of milling loss and lost juice % fibre type approaches. It combines the technological and statistical approaches. However, the influence of the nature of the fibre (ratio of pith to fibre bundles and rind and node characteristics) can have an overwhelming effect on all-important preparation and compressibility of the cane and bagasse.

STATISTICAL EVALUATION OF MOLASSES LOSS

Extraction of non-pol

An important aspect of predicting losses in the boiling house from the non-pol in cane is the extent to which these enter mixed juice. Up to the present time, owing to the imprecise method of measuring non-pol remaining in bagasse via the purity of last expressed juice, the total non-pol in cane has a small margin of error. It is therefore safer to make use of extracted non-pol (in mixed juice) for correlations involving boiling loss. The non-pol extraction at individual factories averages from 85 to 94%. A statistical analysis of 1971–72 factory averages indicates:

$$E_n = 1{\cdot}033\ E_p - 9{\cdot}375 \quad r = 0{\cdot}525^{**} \ldots\ldots (12)$$

with a standard error of 1·72. By taking the extraction of non-pol as proportional to pol extraction, very little additional error is introduced.

At this stage there is very little point in speculating on the true relationship between the two extractions. This will no doubt become clear when more accurate data are available. Incorporating purity of mixed juice and reducing sugar ratio does not improve the relationship. One point is very clear and that is that it is more direct and more accurate to use the non-pol actually extracted in mixed juice than to attempt a prediction of what should be extracted. For the present therefore, analyses should be based on non-pol extracted.

Balance of extracted non-pol

The influence of both extracted non-pol and reducing sugars on the amount of molasses formed may also be illustrated using the data from Darnall for the period 1960 to 1971–72:

$$M_c = 1{\cdot}4407\ N_{ec} + 2{\cdot}4860\ R_e/N_e - 0{\cdot}5868 \quad R = 0{\cdot}8979^{***} \ldots\ldots\ldots (13)$$

and for 1971–72:

$$M_c = 1{\cdot}2375\ N_{ec} + 1{\cdot}5730\ R_e/N_e + 0{\cdot}0147$$
$$R = 0{\cdot}8937^{**} \quad \ldots\ldots\ldots (14)$$

Similar correlations for the whole industry are at a low level but this is not surprising considering that the relationship is not as specific as that in equation (15) below.

Statistical analysis of monthly data for the whole industry during 1971–72 shows that the amount of extracted non-pol entering the molasses is dependent on the ratio of reducing sugar to non-pol in mixed juice:

$$N_{mc} = 0{\cdot}6628\ N_{ec} + 1{\cdot}8562\ R_e/N_e - 0{\cdot}2118$$
$$R = 0{\cdot}9838^{***} \quad \ldots\ldots\ldots (15)$$

A similar result has been found for individual factories, e.g. Darnall, 1971–72:

$$N_{mc} = 0{\cdot}6601\ N_{ec} + 2{\cdot}3479\ R_e/N_e - 0{\cdot}3190$$
$$R = 0{\cdot}9071^{**} \quad \ldots\ldots\ldots (16)$$

This would indicate that in the case of less mature cane, more non-pol would enter molasses streams while presumably less would enter the filter cake, i.e. clarification would be less efficient.

Purity of final molasses

Now that molasses Brix is measured in South Africa by refractometer the dependence of final molasses purity on reducing sugar ratio is easily demonstrated. For example, the industrial average data show that the relationship for 1971–72 was:

$$P_m = 45{\cdot}9327 - 1{\cdot}5428\ R\%S \quad r = -0{\cdot}8750^{***} \quad (17)$$

The amount of variance accounted for may be improved slightly by using the ratio of reducing sugars: non-pol in place of reducing sugars % sucrose. For example, equation (17) becomes:

$$P_m = 54{\cdot}9173 - 64{\cdot}7905\ R_e/N_e \quad r = -0{\cdot}9067^{***} \quad (18)$$

The equivalent for Darnall during 1971–72 was:

$$P_m = 48{\cdot}7262 - 52{\cdot}5368\ R_e/N_e \quad r = -0{\cdot}8656^{***} \quad (19)$$

The purity of molasses may be expressed in terms of the sucrose to non-sucrose ratio with no significant change to the correlation coefficients as shown by the following analyses which correspond to equations (18) and (19):

$$S_m/N_m = 1{\cdot}0721 - 1{\cdot}7601\ R_e/N_e \quad r = -0{\cdot}9035^{***} \quad (20)$$

$$S_m/N_m = 0{\cdot}8798 - 1{\cdot}3029\ R_e/N_e \quad r = -0{\cdot}8673^{***} \quad (21)$$

In its physical interpretation this indicates that about 80% of the variation in the ratio of sucrose to non-sucrose in molasses is accounted for by the fraction of reducing sugar in total non-pol extracted from cane.

Loss of sucrose in molasses

It has been shown in the foregoing that the amount of non-sucrose entering molasses and the amount of sucrose in molasses associated with the non-sucrose may both be very closely related to the amount of non-pol extracted and the amount of reducing sugars in this non-pol. It would therefore be expected that sucrose in molasses would be closely related to non-pol extracted and the amount of reducing sugars in these.

Statistical analysis of the 1971–72 data for the industry shows that:

$$S_{mc} = 0{\cdot}3002\ N_e - 0{\cdot}4386 \quad r = 0{\cdot}4786\ \text{N.S.} \quad (22)$$

and in the case of Darnall for the same period:

$$S_{mc} = 0{\cdot}01439\ N_e + 0{\cdot}6768 \quad r = 0{\cdot}4495\ \text{N.S.} \quad (23)$$

The above are included merely for illustration of the fact that non-pol alone accounts for relatively little of the variance in molasses loss. Both correlations are non-significant ($r^* = 0{\cdot}666$).

By including the influence of reducing sugars in a multiple regression analysis the correlation is improved as shown by the following equations corresponding to (22) and (23):

$$S_{mc} = 0{\cdot}7353\ N_{ec} - 2{\cdot}5011\ R_e/N_e + 0{\cdot}0958$$
$$R = 0{\cdot}7764^{*} \quad \ldots\ldots\ldots (24)$$

$$S_{mc} = 0{\cdot}3894\ N_{ec} - 1{\cdot}0028\ R_e/N_e + 0{\cdot}3349$$
$$R = 0{\cdot}7332 \quad \ldots\ldots\ldots (25)$$

The data for Darnall just fail to reach the 5% level of significance ($R = 0{\cdot}758$). However, equations (24) and (25) which allow for the influence of reducing sugars show an improved level of significance over those based on non-sugars alone as shown in equations (22) and (23). The levels of correlation are not yet very satisfactory since only about 56% of the variance is accounted for. This is not as encouraging as the high levels of correlation in equations (15), (16), (20) and (21) may have suggested.

The above relationships are not unexpected since the reducing sugars:non-pol ratio in mixed juice is likely to have a close association with the reducing sugars:ash ratio in final molasses which in turn is associated with improved exhaustibility[8]. NOEL[9] has attempted to predict sucrose lost in molasses % cane using a target purity based on reducing sugars:ash ratio and a factor of the non-sugars in clarified juice at 25 factories. The results of actual and estimated molasses losses published by this author have been analysed statistically to show that there is a correlation coefficient of 0·7537 between the two sets of data and this is consistent with the levels of correlation in equations (24) and (25).

(*To be continued*)

[8] BRUIJN *et al.*: *Proc. 46th Congr. S. African Sugar Tech. Assoc.*, 1972, 103–109.

[9] *Proc. 11th Congr. I.S.S.C.T.*, 1962, 901–905.

Cane mechanization in the West Indies[1]

MOST discussions of mechanization in the West Indies sugar industry are in the context of field operations, which are heavily labour-intensive and which account for the greater proportion of the total cost of producing a ton of raw sugar.

As in the factories, many hand operations in the field have undergone the change to mechanization by a gradual process of evolution. Tractor-driven ploughs and harrows have replaced animal-drawn equipment and manual digging. Chemical and mechanical weeding have replaced hoeing and hand-weeding. In some places planting is carried out by machines and this is expanding. Mule carts have almost entirely been replaced by tractors and trailers and trucks for the conveyance of cane to the factories or railway sidings. Harvesting—the cutting and loading of the cane—still, however, largely remains a hand operation and it is here that the industry is most labour-intensive and it is in this area that in recent years consideration has been given increasingly to mechanization. The justification for changes from manual to mechanical operations of the agricultural processes—and particularly harvesting—are: improved efficiency and productivity; the lack of agricultural labour in many areas; the fact that manual operations in agriculture are becoming less and less attractive in the West Indies, particularly amongst school leavers, leading to a labour force of increasing age and smaller numbers; and the urgent need to contain and reduce production costs. It is with these problems in mind that the West Indies sugar industries have given increasing thought to mechanical harvesting and loading of cane and have for some years been conducting investigations and experiments in the use of mechanical harvesting and loading equipment.

Mechanical cane harvesting and loading

In the Commonwealth, the Australian cane harvest is now almost entirely cut and loaded mechanically. At the other end of the scale, in Mauritius and Fiji these operations are still performed manually. The West Indies fall between these two extremes. In 1968, some 98,000 tons of cane were mechanically harvested or less than 1% of the total of cane reaped. By 1972, the figure had risen to around 150,000 tons or a little over 1% of the total, so the increase in mechanization has not been spectacular. But these years had seen continuous experiments and research in attempts to determine the feasibility and economics of mechanized harvesting in local conditions. Cane cut manually but loaded mechanically was 2,338,000 tons in 1968, or 19% of the total, rising to 4,223,000 tons in 1972, or 34% of the total cane reaped. It will be seen that commercially the mechanical loading of manually-cut cane has progressed further than the use of mechanized harvesters. The following summarizes briefly the developments in individual territories.

In *Barbados*, investigations have been made on the use of some of the harvesters operating in other countries, e.g. Australia and the United States, to determine whether these machines are suitable in Barbados conditions and what changes would have to be made in land preparation and lay-out of fields. At the same time, an entirely new type of harvester has been developed which it is hoped will be suitable for smaller estates and trials with a prototype machine have been encouraging. Mechanical loaders have also been used experimentally and in 1972 some 50 loaders handled 165,000 tons of manually-cut cane, or 16% of the total. These investigations are continuing. Three harvesters of the conventional "chopper" type will be used during the 1973 crop and seven "whole-stick" harvesters of the type developed locally in conjunction with an English firm of agricultural engineers.

At present, in *Guyana* all cane is cut and loaded by hand, mainly into punts, for transportation by water to the factories. Over 99% of the cane is grown on cambered beds where cane rows run across and not along the beds in the majority of fields. Fields, almost entirely surrounded by water, are generally of about 10 acres, with a maximum width of the order of 400 ft to facilitate in-field manual carriage of cane and other materials.

In 1969 the industry instituted a programme of research into possible ways of mechanizing the harvesting of cane in preparation for the time when it may become necessary. It was immediately apparent that no mechanical harvesting system in being or projected would be suitable for the field layouts presently existing in Guyana and a survey of mechanization methods elsewhere indicated that some type of ridge-and-furrow layout would be essential. Accordingly, experimental fields were laid out on new flat land in order that the newer techniques of ridge-and-furrow culture could be investigated. The purchase of a Louisiana-type harvester on an experimental basis has enabled a study to be made of ground conditions suitable for mechanical harvesting, and how these conditions may be produced in the heavy clays. As more suitable equipment becomes available, the area under ridge-and-furrow culture is expanding and agronomic research is being directed to optimizing yields on these layouts. Present work is concerned with all aspects of changing existing fields from cambered beds to ridges-and-furrows, and with laying out some new land in larger fields entirely suitable for full mechanization.

The investigations into mechanical harvesting of cane have therefore not yet reached the stage of an examination of different types of harvesting machines and most of the land suitable for mechanical cutting still has to be harvested by hand.

Parallel with the research into field layouts investigations have proceeded into methods of machine-loading of cane on existing fields using existing transport and factory unloading methods. No commercial cane loading equipment is entirely suitable for this duty but it is hoped that experiments this autumn will show that the problems of machine loading may be solved by small adaptations to available machinery.

[1] *Ann. Rpt. W.I. Sugar Assoc.*, 1972, 39–42.

THE NEW REVOLUTIONARY GREEN AND BURNT CANE HARVESTER

CLAAS
LIBERTADORA 1400

collects cuts chops

cleans loads GREEN

and burnt cane

CUTTER HEAD
Fully floating over uneven ground. Cutting and chopping width 1400 mm – 56". Vertical side cutter for overhanging crop. Two rotary dividers for lodged cane. Designed for upright or lodged cane in fields with more than 200 t/ha. No feedrollers causing blockages.

DRIVER'S CABIN
Ventilated. Comfort seat. Extra large windows for max. visibility. Only SIX levers to operate.

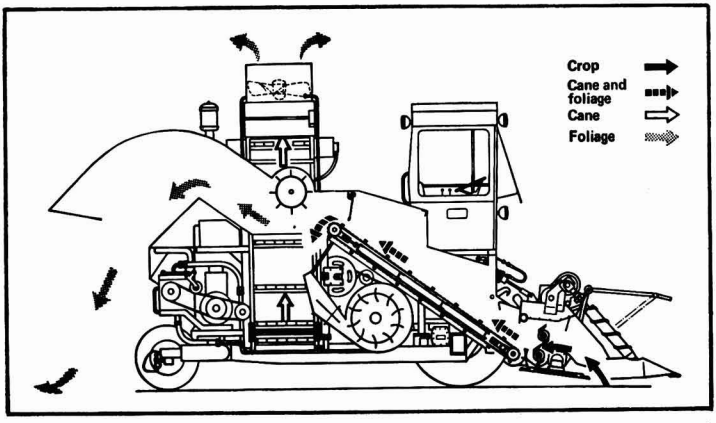
HYDRAULICS
Fully hydrostatic ground drive. Fully hydrostatic steering. Hydraulic lifting system for cutterhead. Hydraulic cross elevator drive. Hydraulic axial-type cleaning fan.

CLEANING SYSTEM
Double base cutter throw out. Perforated extra wide main elevator 1400 mm – 56". Twin-type main cleaning fan. Perforated unloading elevator. Axial-type cleaning fan.

Development of this new harvester for GREEN and burnt cane began in the early 60's and serial production started 1970.
The machine began its conquest of the world's sugar cane fields in Middle and South America by proving

1. its high capacity – up to 60 t/h,
2. its minimal amount of trash, never reached by others, and
3. its easy operation and lowest operating and maintenance costs.

The big 190 HP MERCEDES engine, the heavy duty hydrostatic drive, the heavy duty frame and special low pressure tyres ensure operation under all field conditions. Do you want to reduce your production costs? This is your cane harvester – a German quality product from one of the three biggest manufacturers of combine harvesters in the world.
Do contact us!



GEBR. CLAAS MASCHINENFABRIK GMBH **Dept. for Sugar Cane Machinery** **4834 HARSEWINKEL**
West Germany

There are as yet no plans for the introduction of any harvesting mechanization on a commercial scale.

Mechanical loading was introduced in *Jamaica* almost overnight on one estate as a result of an acute shortage of hand loading labour during the early 1960's. Since then the practice has spread to every estate and at present about 90% of the cane is mechanically loaded. Considerable investigation has been carried out in the meantime and plans made for changing field layouts and the management of the crop in order to meet the requirements of increased mechanization in improved irrigation and drainage as well as in harvesting itself.

There are essentially two types of loaders in use: the push-piler loader and the heap loader. The former appears to work faster but takes up a greater percentage of dirt; the latter apparently loads less but cleaner cane in a given time.

Following visits to areas where mechanical harvesting is carried out fairly extensively, two chopper-type cane combines and one green whole-stalk cutter have been tried in various field conditions during the last three years. So far, the whole-stalk cutter has not been able to cope satisfactorily with the average Jamaican crop of 30–35 tons per acre but the combines have shown some promise. The trials are continuing.

An awareness of changes in field conditions necessary for successful mechanical harvester and loader operations is slowly developing. In general, a ridge-and-furrow system of cultivation prevails. Field sizes are being increased and land levelling and land planing are becoming general on irrigated estates, and in consequence furrow runs are being lengthened.

Following a series of experiments with mechanical harvesters from various sources, two chopper-type harvesters were on trial in *St. Kitts* during the 1972 crop. The results of the trials have been assessed in regard to the machines themselves, field preparation for mechanical harvesting, transport to the factory and costs. It is proposed to continue the trials during the 1973 crop. Mechanical loading of manually cut cane has been in operation in St. Kitts for some years and virtually the whole of the cane crop is now mechanically loaded by push-piler loaders.

Land preparation for planting in *Trinidad* is fully mechanized and over the last decade considerable progress has been made towards mechanizing harvesting operations.

In 1962, two mechanical methods of cane harvesting were simultaneously introduced. In the hill lands of the South, this took the shape of only partial mechanization involving the employment of self-loading trailers (a modified South African Bell trailer system) but in the North flat lands were converted to a Louisiana-type ridge cultivation and full mechanization in the form of chopper-harvesters was commenced on an experimental basis.

The self-loading trailer for harvesting on hilly terrain was successfully introduced without posing any major problems in labour displacement or in conversion from established cultivation methods. Such units can load up to 100 tons per 8-hour day, especially when working on hillsides, which assist the winching of bundles on to the trailer since the bundles are made across the slope. From the introduction of the self-loading trailers in 1962 until the end of the 1972 crop, over 5 million tons of cane have been loaded in Trinidad by this method.

Fully mechanized harvesting started in 1962 with the introduction of the Massey Ferguson 515 Combine. This did not, however, prove of robust enough design for local conditions, and 1964 saw the first arrival on the scene of the Cary "Cane Combine". At first many problems were encountered with these machines but modifications were carried out locally with great success.

Towards the end of 1969, the Thompson Duncaña combine was introduced and though numerous modifications were carried out within less than a year it was discovered that this machine was totally unsuitable for local conditions and it was withdrawn as an operating unit.

In 1972, yet another combine, the Massey Ferguson Cane Commander 201, made its appearance. Fewer modifications were required than had been found necessary in the case of the Cary in its earlier days and it proved to be easier adapted to the local field conditions. Both units, Cary and Massey Ferguson, have certain advantages and disadvantages over each other.

Mechanical harvesting is only carried out on the flat land in the North, where 50% of the acreage has already been converted from cambered bed cultivation to (Caroni) ridges. It is hoped that conversion of the remainder (12,000 acres) will be completed long before the end of the second decade of mechanized harvesting.

Caroni Limited is the only sugar company in Trinidad in which any programme of full mechanization exists. Five Cary harvesters and one Massey Ferguson 201 are now in operation.

Two types of in-field transport are currently used in the mechanical operations in Trinidad:

(1) the tractor-drawn trailer—a County all-wheel-drive tractor, Models 1004 and 1124, and

(2) the Cary "Cane Buggy", a self-propelled unit equipped with hydrostatic drive and high flotation tyres.

Tractor-drawn trailers operate with a capacity of 6 tons of cane from field to trace, where lighter tractors are then used to transport them directly to the factory. This method is used for operations carried out within a 5-mile radius of any factory.

During this "decade of development", most of the major problems of mechanical harvesting under local conditions have been overcome. As a result, during

1972, the wettest crop since mechanical harvesting was introduced, a total of 132,000 tons of cane, was harvested by the six operating units.

Mechanical harvesters have already reaped a total of 700,000 tons at Caroni Ltd. with an individual record of 26,000 tons by one unit in a crop. At such time as the entire flat land in Trinidad comes to be mechanically harvested, it is anticipated that about 750,000 tons of cane will be cut in this manner each year.

Cane mill extraction

The relation between juice extraction, fibre index, top-pressure and circumferential roller velocity

By A. T. de BOER*

It is undeniable that the rate of extraction performed by a cane mill is influenced by the roller circumferential velocity. The velocity is a criterion of major importance for mill design engineering and it might be of interest to consider this subject further.

In a previous paper[1], entitled "Two-roller cane mills. A reappraisal in the light of value egineering of milling", a relation was established between the velocity and the extraction in order to provide a proper function description. Reference is made to equations (50) and (51)[2] the latter of which was derived for initial extraction mills only.

Though, provisionally, these equations should be handled with a certain reserve, it seems that they are suitable as a practical criterion for engineering purposes.

In a modified form equation (50) could also be written for 3-roller mills as:

$$N = \frac{F}{DL} \times \frac{10^8 \left(\frac{I_{cb}}{I_{w2}}\right)^6}{1{\cdot}02\sqrt{\frac{W_2}{D}}} \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

and for 2-roller mills as:

$$N = \frac{F}{DL} \times \frac{10^8 \left(\frac{I_{cb}}{I_w}\right)^6}{1{\cdot}30\sqrt{\frac{W}{D}}} \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

where:

F = hydraulic force exerted on the top roller in kg
D = roller diameter in mm
L = roller length in mm
W_2 = work-opening (in operation) at the discharge side of a 3-roller mill in mm
W = work-opening of a 2-roller mill in mm
I_{cb} = fibre index of the prepared bulk cane under no (atmospheric) pressure in kg fibre/bulk litre of cane
I_{w2}
and
I_w = fibre index of the cane at the discharge work-opening of a 3-roller and a 2-roller mill, respectively, in kg fibre/litre escribed volume through the discharge work-opening
N = variable factor dependent upon the circumferential velocity of the rollers

(For further explanation, definitions, terminology and bibliography, the reader is referred to the above-mentioned paper[1].)

For the first extraction mills the rate of extraction is a function of I_{w2} or I_w, for 3-roller and 2-roller mills respectively, [equations (24) and (25) of the paper[1]].

For the subsequent mills it would be more complicated to derive the extraction directly from the fibre index. The influence of imbibition and/or maceration has then to be taken into account.

Equation (51)[2] should correctly be written as:

$$\log N = 0{\cdot}246\, v_c + 1{\cdot}278 \quad \ldots\ldots\ldots\ldots\ldots (3)$$

The hydraulic force F evidently is limited by the allowable pressure to be exerted on the bearings.

Throughout the whole range of standard roller sizes the factor $\frac{F}{DL}$ could be put at a tolerably constant value of 0·30–0·34 kg.mm^{-2} projected roller surface.

I_{cb} is dependent on the fineness of preparation [equation (16) and Table IV[1]].

For a certain required extraction rate and a given fibre content f, I_{w2} or I_w could be derived from equations (24) and (25).

For the factor $\frac{W_2}{D}$ or $\frac{W}{D}$ a reasonable value of 0·03–0·04 could be substituted for initial approximation.

By substitution of all these values into equations (1) or (2), the variable factor N could be found and subsequently from equation (3) the circumferential velocity v_c. This datum is now readily available to

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[1] DE BOER: *I.S.J.*, 1972, **74**, 103–108, 136–140, 169–172.
[2] *ibid.*, 1973, **75**, 32.

be used for further calculations and it should be examined whether the provisionally adopted value of $\frac{W}{D}$ needs correction.

Within the frame of the reservations[1] made it would be justifiable to consider the found velocity as the maximum at which the required extraction could be accomplished.

In discussions about this subject with prominent scientists it has been the writer's experience that one was inclined to use equation (3) in general for all the mills, instead of restricting it to the first extraction mills exclusively. This, of course, is unavoidable when no information is given about the subsequent mills. However, when using equation (3) for the subsequent mills the calculated results prove to be at variance with actual results, so that a correction becomes necessary. It is the aim of this paper to fill this deficiency.

Equation (3) gives a linear relation between v_c and log N.

Using equation (1), the value of N was calculated for all the last mills (4th and 5th mills) from the respective data derived from Java statistics as far as they were complete.

Arranging the logarithms of N according to their frequency within velocity ranges between narrow but constant intervals the results were found such as are collected in Table I.

Table I

velocity range m.min^{-1}			
2·5–3·5	3·5–4·5	4·5–5·5	5·5–6·5
frequency of log N			
1·74123	1·59296	1·77327	1·91824
1·83954	1·68007	1·69993	1·70698
0·32428	1·81803	1·87731	
0·86688	1·45999	2·14654	
	1·06893	1·35064	
	1·79881	1·52388	
	1·54839	0·83442	
	1·00130	0·70329	
	1·83251	1·69020	
	2·48483	1·40019	
		1·97428	
		1·89315	
		1·86994	
		2·19720	
		2·60659	
		0·89818	
Total 4·77193	16·28582	27·42101	3·62522
number of cases 4	10	16	2
mean of log N 1·19298	1·62858	1·71381	1·81261
mean of N 15·6	42·5	51·7	65·0

The found values of N are plotted in the v_c/N diagram of Fig. 1 indicating at the same time, marked with a triangle, the means of N at the various velocity intervals.

It appears that the means ($v_c = 4; N = 42{\cdot}5$), ($v_c = 5; N = 51{\cdot}7$) and ($v_c = 6; N = 65{\cdot}0$) are situated upon

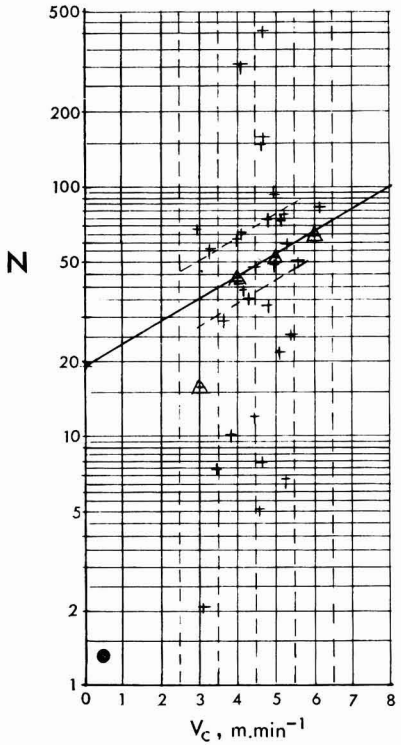

Fig. 1

or very close to a straight line cutting the N-axes ($v_c = 0$) at $N = 19$. This latter, at least, deserves attention for this point again coincides with the point ($v_c = 0; N = 19$) found in the previous paper[1], derived from DEERR's results under static conditions.

Obviously the mean ($v_c = 3; N = 15{\cdot}6$) deviates excessively from the straight line concerned.

It should be noted that this mean is the result of a very small number (viz. merely four) of observations. It appears now that in one of these four cases the statistics give an exorbitantly high figure of the fibre index I_{w2} compared with all other cases resulting in an extremely low figure of log N. This one figure, of course, influences the result very strongly and very likely should be ascribed to inaccurate observations.

Eliminating this one case, the mean of N at $v_c = 3$ would become 30·4 which again approaches very closely to the straight line.

When observing the plotted values of N in the diagram in Fig. 1, it is striking that high fluctuations occur within the same intervals of v_c. Evidently there are a great number of circumstances, apart from the velocity and likely beyond the control of the designer, which influence the mill performance and find expression in the fluctuations.

It may hardly be justified to draw a conclusion from the given data. Yet, elaborating a practical criterion for the velocity would contribute to an intelligent design engineering and would not even be restricted to that. It is in that direction that the writer's attempts should be considered.

The process of deriving the v_c/N function is here given *in extenso*. From a more superficial review of the plotted values, a different interpretation might otherwise be given.

On further examination, almost the same behaviour was found with the third, fourth and fifth mills and it stands to reason that all subsequent mills behave similarly. The second mills, on the other hand, deviated substantially.

Summarizing, the following functions were derived: For first mills:

$$\log N = 0{\cdot}2360\ v_c + 1{\cdot}278 \quad \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

For second mills:

$$\log N = 0{\cdot}1377\ v_c + 1{\cdot}278 \quad \ldots\ldots\ldots\ldots\ldots\ldots (4)$$

and for further mills:

$$\log N = 0{\cdot}0903\ v_c + 1{\cdot}278 \quad \ldots\ldots\ldots\ldots\ldots\ldots (5)$$

These functions are graphically represented in Fig. 2.

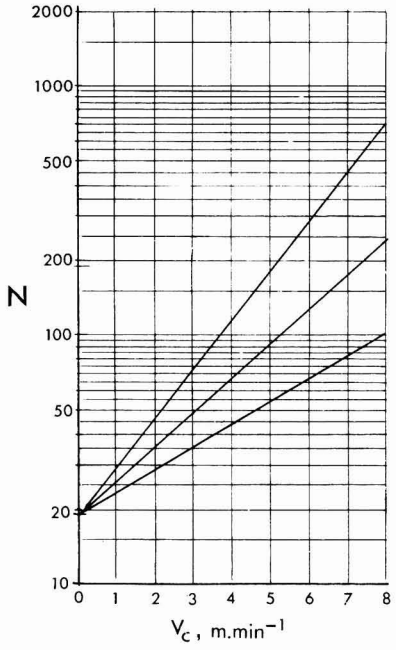

Fig. 2

A comparison of carbonatation and sulphitation decolorization in raw sugar syrups

By F. H. C. KELLY, F. K. MAK and K. C. LOO

(Department of Chemistry, University of Singapore, Singapore 10)

Introduction

COLOURING substances found in sugar plant materials constitute a portion of non-sugars to be contended with in the processing of raw sugar for refining but during this processing other colouring materials also are formed as a result of thermal/chemical degradation of sugars or of reactions with certain of the non-sugar materials present or developed in the process.

In the production of refined sugars the removal of these coloured impurities becomes extremely important particularly in view of an increasing demand for exceptionally high quality refined sugars. Carbonatation and/or sulphitation processes are commonly used for clarification in sugar refining in conjunction with bone char or activated carbon treatment and possibly also ion-exchange processes. Carbonatation and sulphitation involve preliming the raw sugar syrups with calcium hydroxide to a high alkalinity and gassing with carbon dioxide or sulphur dioxide to precipitate calcium carbonate or calcium sulphite. These calcium salt precipitates adsorb colouring and non-sugar impurities, thus providing substantial clarification.

The degree of colour removal from raw sugar syrups by both carbonatation and sulphitation is greatly influenced by the proportion of lime with which the syrups were treated and the final pH to which the process is carried. By closely controlling the temperature at 60° and the syrup concentration at 60% w/w the effect of pH and lime dosage on the degree of colour removal by either carbonatation or sulphitation has been studied and is reported here.

Removal of over 50% of the colouring matter and non-sugar impurities may be achieved by single-stage carbonatation or sulphitation, but better colour removal is possible using double- or triple-stage processes. To avoid the formation of dark coloured

reaction products such as caramel and melanoidin, the temperature should be kept low in the first stage of the multi-stage process where alkalinity is high. As the alkalinity decreases in the second or third stage the temperature may be raised to give a less viscous fluid phase in the subsequent filtration step.

Experimental

(*a*) *Carbonatation and sulphitation*

900 grams of raw sugar were dissolved in 600 grams of distilled water to prepare a 60% w/w raw sugar solution. The solution was limed at room temperature (30°C) with different proportions of calcium oxide expressed as 0·5 g, 1·0 g, 1·5 g, 2·0 g and 3·0 g of calcium oxide per 100 g of raw sugar. The maximum molar ratio of calcium oxide to sucrose is 0·18:1 and represents only a fractional possible concentration of calcium sucrate. The limed solution was filtered to remove any undissolved lime as well as solid impurities present in the raw sugar before it was transferred to a double-necked glass flask partially immersed in a water bath maintained at 60°.

Carbonatation was effected by slowly bubbling carbon dioxide gas through the test solution and withdrawing portions of it from the flask at pH values of 10, 9·5, 9·0 and 8·5 for colour measurement to study progressive decolorization. Time taken for each carbonatation was approximately 2½–3 hours.

Sulphitation was effected by slow gassing of sulphur dioxide through the test solution and withdrawing portions of it from the flask at pH values of 6·0, 5·5, 5·0 and 4·5 for colour measurement. In sulphitation of the limed test solution portions of it were withdrawn at pH values of 10, 9·5, 9·0, 8·5; 8·0, 7·5, 6·5 and 5·5 for colour measurement. Time taken for each sulphitation was approximately 2 hours.

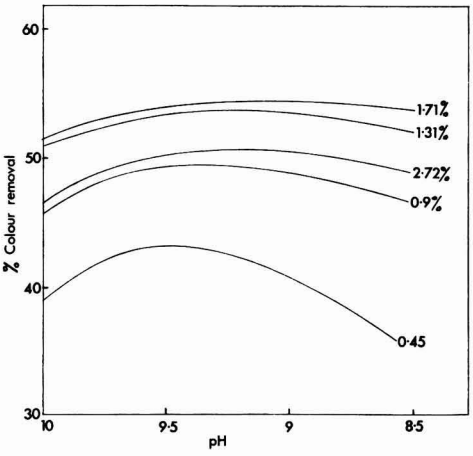

Fig. 1. % colour removal with terminal pH variation at fixed calcium oxide doses in carbonatation

(b) *Colour Measurements*

The carbonatated and sulphitated solutions were filtered or centrifuged to remove the calcium carbonate and sulphite, respectively. A volume of 20 cm³ of filtered or centrifuged solution was adjusted to pH 7 ± 0·1 with hydrochloric acid or sodium hydroxide solution before the colour measurement. Correction was made for any volume change. The adjustment of the solution to pH 7 prior to measurement is important because the colour has been shown by GILLETT[1] to be dependent on pH, and was made to all samples before colour measurement in order to eliminate this influence as a variable.

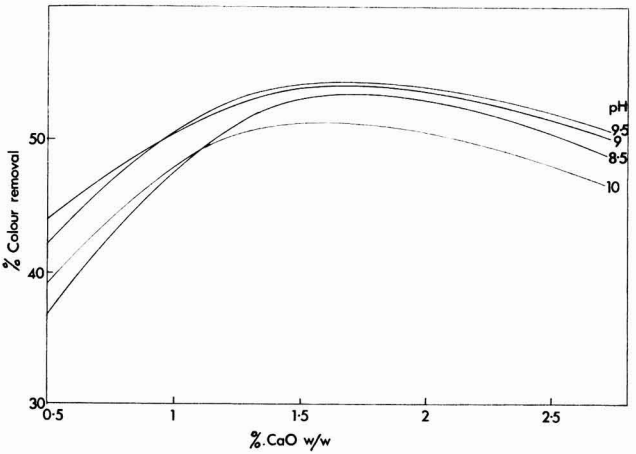

Fig. 2. % colour removal with calcium oxide doses at fixed terminal pH in carbonatation

Normally the filtered or clear solution has to be diluted with distilled water to give an optical density measurable at the internationally accepted wavelength of 420 nm. There was also a strong absorbance band at 290 nm but this was not used in the exercise reported here.

Colour measurements were obtained using a Unicam SP 600 spectrophotometer at wavelength 420 nm and expressed as absorbance per g sugar per cm.

Discussions

An optimum pH of 9·4–9·2 was found to correspond to maximum colour removal in the raw sugar using calcium oxide proportions varying from 0·4%–2·72% w/w as shown in Fig. 1. Generally, maximum decolorization improved from 42% to 55% when addition of calcium oxide was increased from 0·4% to 1·7% w/w but at 2·72% w/w, the highest used in these tests, the colour removal decreased slightly to 50%.

It has also been found, as shown in Fig. 2, that by keeping the final pH constant while varying the

[1] "Principles of Sugar Technology" Vol. I. Ed. HONIG. (Elsevier, Amsterdam) 1953, pp. 214–290.

calcium oxide dosage an optimum occurred at 1·6% w/w corresponding to maximum colour removal around 52%–55%. It may be seen that optimum carbonatation conditions for a 60% raw sugar syrup occurred at a calcium oxide dosage of 1·6% w/w and a final pH of 9·2.

Decolorization has been attributed by BARABANOV[2] to the adsorption of colouring impurities by nascent calcium carbonate precipitate which action is opposed by desorption into the solution. YAMANE[3] suggested that an optimum pH may exist for which adsorption is favoured. It is easy to see that a corresponding optimum calcium oxide addition should exist below which the amount is insufficient to effect reasonable decolorization and above which extra colour materials may be formed, although precipitation from an overdose may also result in calcium carbonate particles having poorer adsorptive capacity for the colour impurities. The effect of lime dosage was also studied in 1935 by SMOLENSKI and KOZLOWSKI[4] who reported a 45%–72% decolorization in raw sugar syrups during carbonatation at 82° using calcium oxide doses from 0·5% to 3·0% w/w.

Sulphitation of raw sugar solutions also showed similar behaviour to carbonatation. Unlike carbon dioxide, sulphur dioxide has a "bleaching" effect on sugar syrups as may be seen from Fig. 3 where 22% colour removal was obtained by the action of sulphur dioxide on unlimed syrup. The "bleaching" effect was no doubt related to saturation of chromophonic double bonds and, as suggested by ZERBAN[5], was associated with the combination of sulphur dioxide with reducing sugars to block the carbonyl groups. This would prevent them from functioning in caramel and melanoidin colour formation which are condensation products between reducing sugars and amino-acids. However, combination of excessive sulphitation and high temperature may also result in undesirable colour formation, as seen from the decreasing portion of the curve.

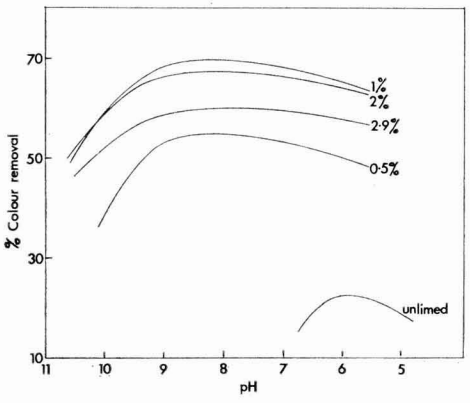

Fig. 3. % colour removal with terminal pH variation at fixed calcium oxide doses in sulphitation

Sulphitation of limed syrups results in adsorption of the colouring materials by the calcium sulphite precipitate. Results of these tests illustrated in Figs. 3 and 4 show an optimum pH of 8·6–8·5 at which the

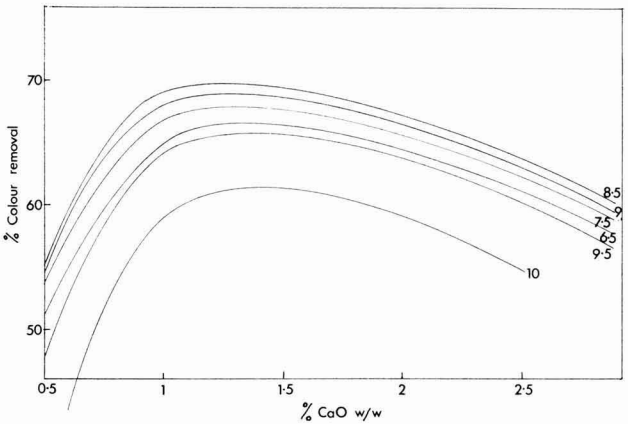

Fig. 4. % colour removal with calcium oxide doses at fixed terminal pH in sulphitation

impurities were most readily adsorbed. The optimum amount of calcium oxide has also been found to be 1·3% w/w, and it is not unexpected that sulphitation gave greater colour removal than carbonatation, which ranged from 60% to 70%, the highest being attained by taking the final pH to the optimum 8·5. Fig. 4 also shows that less colour removal would result if sulphitation was insufficient (pH 10), or excessive (pH 6·5). It may again be seen from Fig. 3 that an overdose of 2·9% w/w calcium oxide resulted in about 10% difference in decolorization from the optimum 1·3% w/w calcium oxide, indicating that the effect of overliming is more serious in sulphitation than carbonatation.

The optimum conditions for sulphitation of raw sugar syrups occurred at 1·3% calcium oxide and a final pH of 8·6. Sulphitation thus requires less lime and also a lower final pH compared with carbonatation.

The optimum conditions, however, are not represented by sharp peaks; this, on the one hand, allows useful latitude in factory operations but, on the other hand, makes it rather difficult specifically to identify optimum conditions simply from factory results.

The raw sugar sample used in this study was supplied by courtesy of Sugar Industries of Singapore Ltd. and was reported to have been imported from Brazil and to have an initial colour value of 8·74 × 10^3 International Units.

[2] *Ref. Zhurn. Khim.*, 1954, 47453.
[3] *Proc. Research Soc. Japan Sugar Refineries, Tech.*, 1954, **3**, 152–165.
[4] *Bull. Assoc. Chim.*, 1935, **52**, 505–515.
Sugar Research Found. Technol. Reprint Series, 1947, **2**.

Sugar cane agriculture

Mechanization of sugar cane harvesting. R. P. HUMBERT. *Outlook on Agriculture*, (I.C.I.), 1972, **7**, (1), 10–15.—The present status of mechanical harvesting is discussed and the many problems that are associated with it. Other matters considered include burning, use of desiccants, the preparation of fields for mechanical harvesting and cane cleaning. It is pointed out that the cost of cane cleaning at the mill is normally high as the equipment may cost a million dollars or more. If the cleaning plant is a wet cleaner, sugar losses of up to 19% make the removal of trash and soil very costly indeed. What is needed is mechanical cutters and choppers that will clean the cane in the field and leave the chopped trash in the field where it belongs.

* * *

Effects of roguing on yield and smut in sugar cane. G. L. JAMES. *Experimental Agriculture*, 1973, **9**, (1), 73–82.—Sugar cane yields and smut incidence levels were observed in Rhodesia in 3 successive crops. The effect of pathogen upon host was primarily one of stress, as smut infection was shown to increase sucrose content of cane, while depressing yields in tons cane/ha. Where infection levels were high, roguing was shown to increase disease incidence. However, smut whip removal was confirmed as the best roguing treatment for commercial fields. Disease control and yield responses related to roguing effort were much better in N:Co 376 than N:Co 310, and, therefore, continued cultivation of N:Co 310 fields with high smut incidence was concluded to be a major hazard to the industry.

* * *

Wattle beetles. ANON. *Ann. Rpt. S. African Sugar Assoc. Expt. Sta.*, 1970–71, 30.—Investigations were continued on the two beetles *Hypopholis sommeri* and *Schizonycha affinis*, which may feed on both sugar cane and the black wattle. Trials with insecticides are reported. There was evidence that "Dieldrin" had a significant residual effect. *H. sommeri* is predominant in some areas and *S. affinis* in others.

* * *

Nematodes and environmental factors. ANON. *Ann. Rpt. S. African Sugar Assoc. Expt. Sta.*, 1970–71, 31. Glasshouse studies on the effects of soil organic matter on nematodes yielded interesting results. The most striking result obtained was when treatments with fresh filter cake and old filter cake in the soil were compared with an untreated control. The numbers of plant parasitic nematodes were vastly reduced by both types of filter cake, but the fresh filter cake was clearly superior in that it caused the numbers of plant parasitic nematodes to be lowest, the numbers of saprobic nematodes to be highest and the numbers of predators to be highest. It has been suggested that the superiority of fresh filter cake may be due to its higher content or raw organic matter, but this has yet to be confirmed.

* * *

Nematodes and root damage. ANON. *Ann. Rpt. S. African Sugar Assoc. Expt. Sta.*, 1970–71, 32.—The harmful effects of two nematodes, *Trichodorus christiei* and *Pratylenchus zeae*, on cane roots are described with the aid of photographs. Cultures containing *T. christiei* caused noticeable root malformations 21 days after exposure, while *P. zeae* was found in the roots after just 1 day's exposure.

* * *

North Coast stunting disease. ANON. *Ann. Rpt. S. African Sugar Assoc. Expt. Sta.*, 1970–71, 36.—Some 6 years ago or more a diseased cane condition in the variety N50/211 was observed on the North Coast of Natal. Material from the diseased area was grown at the Experiment Station for observation and experiment. It now seems that, in view of the similarity of symptoms between North Coast disease and RSD, they are almost certainly the same disease although the possibility exists that different strains of the virus may be involved.

* * *

Weak sands. ANON. *Ann. Rpt. S. African Sugar Assoc. Exp. Sta.*, 1970–71, 42.—In the Natal sugar industry the most important and extensive problem is considered to be the very poor yields which are so often obtained on large tracts of poor coastal sands. Reasonably good plant cane yields may often be obtained but ratoons deteriorate rapidly and frequent replanting is usually necessary. In an all-out effort to solve this problem 7 departments of the Experiment Station are to take part in a co-ordinated project concerning it.

* * *

Results of studies relating to the mosaic-RSD disease complex of sugar cane in Louisiana. R. J. STEIB. *Sugarcane Pathologists' Newsletter*, 1972, (8), 8–9. Small field trials are reported, carried out during 1969 and 1970 and utilizing the three sugar cane varieties L 60-25, L 62-96 and CP 62-258. Plant cane and first ratoon, and four treatments replicated four times in two-row plots, were used. It was concluded that of two plant canes and two first ratoons

(one of each in 1969 and 1970), the reduction in tons per acre caused by mosaic and RSD separately was found to be additive for the three varieties used.

* * *

Ratoon stunting disease diagnosis with elephant grass as an indicator plant. S. MATSUOKA. *Sugarcane Pathologists' Newsletter*, 1972, (8), 10–11.—A method of diagnosing ratoon stunting disease, making use of cultivars of elephant grass (e.g. Napier grass and Merker grass) of high susceptibility showing well defined symptoms, is described. Symptoms of RSD on elephant grass are internal, very similar to the vascular mature node symptoms of sugar cane, but much more conspicuous. They are noticed only in the nodes to which the inoculated leaves are attached, and appear 20 to 30 days after inoculation. The method is claimed to be quick and accurate.

* * *

Pathogenic strains of *Ustilago scitaminea* Sydow. L. S. LEU and W. S. TENG. *Sugarcane Pathologists' Newsletter*, 1972, (8), 12–13.—Experiments are described on the susceptibility of different cane varieties to sugar cane smut, using material from different parts of Taiwan. Results showed that it is evident that two pathogenic strains (Nos. 1 and 2) of the fungus exist in Taiwan and that the two cane varieties N:Co 310 and F 134 can be used to differentiate the strains. More pathogenic strains are expected.

* * *

Hot air and hot water treatment of varieties grown in quarantine. A. HARDING-GOODMAN and G. M. THOMSON. *Sugarcane Pathologists' Newsletter*, 1972, (8), 13.—Because of poor germination of treated setts it was decided to carry out extensive tests on hot air and hot water treatment of a number of varieties to find out whether either treatment was responsible. Setts were subjected to either hot water treatment (50·5°C for 2 hr) or hot air treatment (56°C $\pm$ 0·5° for 8 hr). Hot air-treated setts were the first to germinate in most cases and in the majority of varieties the primary shoots were more vigorous than those from the hot water treatment. It was concluded that earlier germination failures were due more to the condition of the cane than to any shortcomings of the hot water tank. In view of the success of the hot air treatment it was felt it should replace the hot water treatment.

* * *

A summary of varietal resistance ratings to smut in Rhodesia, 1963-71. G. L. JAMES. *Sugarcane Pathologists' Newsletter*, 1972, (8), 14.—A system of rating smut resistance or susceptibility, based on the number of whips per hectare, with 10 ratings from 0 to 3000, is shown in a table. Another table summarizes the smut susceptibility ratings of 79 sugar cane varieties.

* * *

Causal organisms of RSD. ANON. *Sugarcane Pathologists' Newsletter*, 1972, (8), 15.—The suggestion is made that ratoon stunting disease might be caused by a complex of at least two pathogens, a virus and a mycoplasma-like organism. The hypothesis is as yet unproved, but it is supported by the association of host material with virus, sedimentation of infectivity even at very low centrifugation speeds, and its cure by heat treatment, but not by antibiotics. The last of these factors, in particular, would be evidence for the presence of a mycoplasma-like organism, but very detailed investigations are still required. In preliminary tests it was difficult to identify the RSD symptoms in the nodal regions of very young cane plants of many common varieties even when the infected material was planted, but the same seedlings, or their tillers, developed RSD symptoms at maturity.

* * *

Sugar cane diseases in Mozambique. M. SANTOS. *Sugarcane Pathologists' Newsletter*, 1972, (8), 15.—It is suspected that ratoon stunting disease is present in some areas of Maragra Estates, but so far diagnosis has been problematical.

* * *

Studies on incitement of wilt disease of sugar cane under natural conditions. K. K. P. RAO, M. N. SARMA and V. S. REDDY. *Sugarcane Pathogists' Newsletter*, 1972, (8), 16–19.—It was observed that wilt disease was incited when a crop of cane variety Co 419, raised in July on a wilt-infected sandy loam soil in India, suffered from water stress for a period of four months, commencing at the age of six months. The extent of the disease was 68·78%, loss of yield due to it was 39·70% and reduction in juice sucrose 22·8%. The organism predominantly present was *Cephalosporium sacchari* with *Physalospora tucumanensis* in a few cases.

* * *

"Benlate" for controlling pineapple disease. C. RICAUD. *Sugarcane Pathologists' Newsletter*, 1972, (8), 19.—In Mauritius "Benlate" has proved to be superior to the standard organo-mercurial seed cane treatments against pineapple disease.

* * *

Seed cane approved scheme. G. M. THOMSON. *Sugarcane Pathologists' Newsletter*, 1972, (8), 19.—Details of this new scheme in South Africa are given. The scheme aims at the large-scale production, by registered seed cane producers, of approved or certified seed cane for sale to commercial growers. Stringent inspections are carried out by qualified staff. There are now 22 registered seed cane producers actively participating in the scheme, with a total area of over 500 acres. A Seedcane Producers' Association has been formed.

* * *

Roguing mosaic-diseased ratoon seed plots with herbicides in Louisiana. H. KOIKE and R. L. TIPPETT. *Sugarcane Pathologists' Newsletter*, 1972, (8), 20. With plant cane infected, growing setts or young stools are easily removed or dug out but this is not practicable with infected stools in ratoon cane. Other methods of destruction must be sought. The effectiveness of "Erbon" and "Glytac" and methods of

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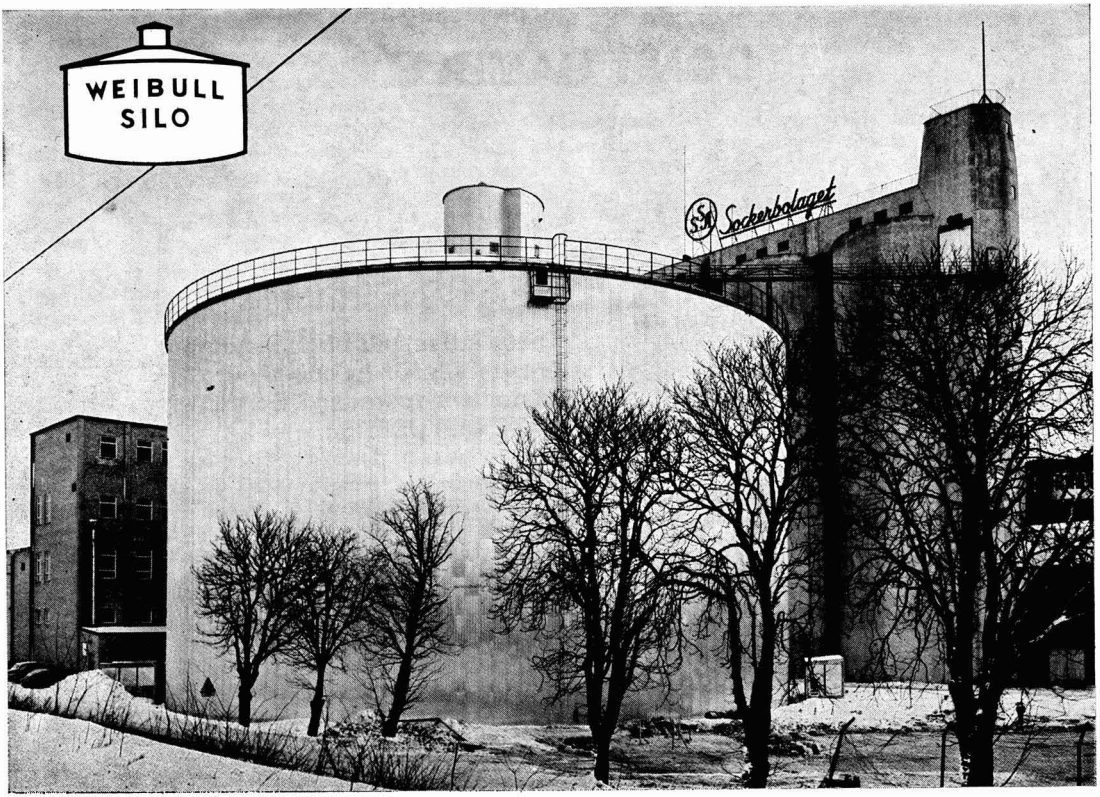

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application are here described. Roguing ratoon cane seed plots with "Erbon" has been included as part of the 1972 recommendations for the control of mosaic disease in Louisiana.

* * *

Sugar cane wilt caused by *Cephalosporium sacchari* and *Fusarium moniliforme* in India. K. T. S. RAJA and S. NATARAJAN. *Sugarcane Pathologists' Newsletter*, 1972, (8), 21–23.—Wilt disease of sugar cane, of wide occurrence in parts of India, affects sugar cane in 3 ways: it reduces germination of seed cane, dries up young shoots and later causes wilting of the cane stalks. Previous work on this somewhat mysterious disease, which may be due to two organisms, is reviewed. The only practical solution to the wilt disease problem appears to be the use of cane varieties of high resistance.

* * *

Strain D of sugar cane mosaic virus in India. K. S. BHARGAVA, R. D. JOSHI and K. M. LAL. *Sugarcane Pathologists' Newsletter*, 1972, (8), 23.—What is claimed to be strain D of sugar cane mosaic disease is reported from Gorakhpur—the strain's first appearance in India. Strains already known to occur are A, B, and F.

* * *

Isolation methods for the causal agent of leaf scald disease. G. J. PERSLEY. *Sugarcane Pathologists' Newsletter*, 1972, (8), 24.—Difficulties in isolating the causal agent of leaf scald disease (*Xanthomonas albilineans*) have been experienced by many workers. Difficulties were removed by using a special medium to which penicillin G had been added. The methods adopted are explained.

* * *

Sugar cane diseases in French-speaking West Africa south of the Sahara. H. BARAT. *Sugarcane Pathologists' Newsletter*, 1972, (8), 25–26.—The diseases known to occur are discussed, such as ring spot, red spot of leaf sheath and pineapple disease. Reference is made to the existence of cane smut in the Upper Volta, caused by unofficial cane introductions. It is concluded that although some dangerous mistakes have already been made, the phytosanitary situation of sugar cane in West Africa is still good: no gummosis, leaf scald or serious virus disease has been seen to occur in the area. If a more rigid policy of quarantine could now be applied for the importation of sugar cane varieties, future production would be at an advantage over older sugar cane-growing areas.

* * *

Assessment of yield loss due to yellow spot. C. RICAUD. *Sugarcane Pathologists' Newsletter*, 1972, (8), 27. Yellow spot (*Cercospora koepkei*) is severe in the super-humid areas of Mauritius (annual rainfall above 250 cm) on highly susceptible varieties. Fortunately, the most highly susceptible variety B 3337 has been taken out of cultivation and the replacement varieties are either resistant or not as susceptible as B 3337. Although the problem is not acute at the moment and the area where the disease can be at its worst is restricted, it is feared that the disease is yet another unwanted problem in that area where conditions for cane growth are already marginal (overcast sky, high rainfall, chlorotic streak disease, etc.). Results are given of trials undertaken since 1969 with the systemic fungicide "Benomyl" ("Benlate"). Although not giving complete protection at the frequency used, this fungicide has been found very effective against the fungus.

* * *

Investigations on the relationship between stomate characters and downy mildew resistance to sugar cane. N. D. STEVENSON. *Sugarcane Pathologists' Newsletter*, 1972, (8), 28–32.—Where downy mildew (*Sclerospora sacchari*) is troublesome there is need for a rapid screening test for resistance to the disease. Such a test would enable many susceptible clones to be eliminated in early stages of a selection programme and to reduce the wasted effort in testing them for agronomic desirability. It was found that the number of stomates per unit leaf area in early experiments appeared strongly related to resistance to downy mildew disease but in later experiments with different clones there was no such strong relationship.

* * *

Interrelationship of a fungus, *Curvularia lunata*, with root-knot nematode *Meloidogyne javanica* in sugar cane seedling blight. S. M. P. KHURANA and S. SINGH. *Sugarcane Pathologists' Newsletter*, 1972, (8), 33.—A glasshouse study is reported which was undertaken to determine the relationship of the fungus to the nematode. The occurrence of *Meloidogyne javanica* as a parasite of sugar cane roots is well known, but infection of the roots by *Curvularia lunata* is a new phenomenon, although the fungus has been found on the leaves of many varieties of sugar cane.

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Red rot leaf infection. C. RICAUD. *Sugarcane Pathologists' Newsletter*, 1972, (8), 33.—Foliar infections of red rot are mentioned. They are considered to be associated with dry atmospheric conditions.

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Results of some experiments on smut of sugar cane in Tamil Nadu state, India. V. DURAIRAJ, S. NATARAJAN, N. J. AHMED and D. PADMANABHAN. *Sugarcane Pathologists' Newsletter*, 1972, (8), 34–35.—Sugar cane smut (*Ustilago scitaminea*) is the most important sugar cane disease in Tamil Nadu, causing heavy yield reductions. As many as 140 varieties have been screened between 1963-64 and 1970–71. The reaction of the varieties are summarized in this paper: 29 were highly resistant and 40 moderately so. The influence of temperature and rainfall on disease incidence have also been studied.

* * *

Alternative hosts for diseases of sugar cane. P. B. HUTCHINSON. *Sugarcane Pathologists' Newsletter*, 1972, (8), 36.—A preliminary list of plants which are known to be hosts for sugar cane diseases has recently

been compiled. It is hoped that sugar cane pathologists throughout the world will assist in keeping the list up-to-date.

* * *

Sugar cane diseases in Taiwan. H. T. CHU. *Sugarcane Pathologists' Newsletter*, 1972, (8), 39–40.—See *I.S.J.*, 1973, **75**, 177.

* * *

Elephant grass, an indicator plant for ratoon stunting virus of sugar cane. S. MATSUOKA. *FAO Plant Protection Bull.*, 1971, **19**, (5), 110–115.—See *I.S.J.*, 1973, **75**, 312.

* * *

Effect of the number and position of buds on a sett on the clump formation and yield of sugar cane. R. R. PANJE, P. S. GILL and B. SINGH. *Indian J. Agric. Sci.*, 1971, **41**, 431–440; through *Hort. Abs.*, 1972, **42**, 826. Patterns of germination and clump formation were compared from 3-, 4- and 5-budded setts. The second bud gave the highest germination, followed by the first, and the rest of the buds followed in descending order. Clump weights showed the same trend. The second bud always tillered more than the first. Increasing the number of non-terminal buds by using 4- and 5-budded setts did not increase the overall germination capacity, but it increased the mean clump output. Two functioning buds led to as much clump output/sett as 3 buds, and a middle bud germinating alone on a 3-budded sett led to about 80% of the output obtained when all 3 buds were functioning. The highest mean clump output of 5-budded setts was reflected in sugar cane yield at harvest and was about 10% more than that of 3-budded setts.

* * *

Selection in two seedling crops of four sugar cane progenies. N. I. JAMES and J. D. MILLER. *Crop Science*, 1971, **11**, 245–248; through *Hort. Abs.*, 1972, **42**, 826.—Phenotypic correlations were obtained among stalk number, stalk diameter and Brix, within and among the plant cane seedling crop, first ratoon seedling crop and the plant cane clonal crop, in progenies of four sugar cane crosses. Stalk number in seedling crops was not a reliable index of clonal crop performance. Stalk diameter was more reliable, particularly in the plant cane seedling crop. Correlation coefficients for Brix between the two seedling crops and the clonal crop were similar to those for stalk number, both characters being less reliable than stalk diameter as selection criteria.

* * *

Studies on the effect of increasing seed rate on the yield and quality of poor tillering varieties of sugar cane. B. K. MATHUR and A. SINGH. *Ind. J. Agron.*, 1970, **15**, 227–228; through *Hort. Abs.*, 1972, **42**, 826. Increases of 15% and 30% in the normal (unspecified) planting rate increased tillering, millable cane yield and quality in the sugar cane variety CoS 575. Similar effects were observed in the variety BO 17 for a 15% increase in planting rate.

Intercropping of maize in spring-planted sugar cane gives high profits with adequate nitrogen use. R. L. BHOJ and P. C. KAPOOR. *Indian J. Agron.*, 1970, **15**, 242–246; through *Hort. Abs.*, 1972, **42**, 827.—When spring-planted sugar cane was intercropped with maize, cane germination was not adversely affected. Tillering, millable cane production and yield were all reduced but juice quality was slightly improved. A supplementary application of nitrogen at 112 kg/ha reduced the loss in cane yield and the intercropping was more remunerative than a pure cane crop.

* * *

Studies with "Dowpon", 2,4-D and "Tafazine 50-W" on control of weeds in sugar cane. G. K. PATRO, G. C. TOSH and A. MISRA. *Madras Agric. J.*, 1971, **58**, 528–530; through *Hort. Abs.*, 1972, **42**, 827. "Dalapon" (as "Dowpon") at 5·60 kg/ha or "Simazine" (as "Tafazine 50-W") at 3·95 kg/ha applied 5 days after planting, or two applications of 2,4-D at 2·24 kg/ha 5 and 25 days after planting, were significantly superior to manual weed control. No herbicide affected germination adversely. The highest cane yield and greatest net return came from the "Simazine" treatment.

* * *

The action of nutrients on sugar cane in Rodeo series soils. L. G. SEGURA. *Agronomía Tropical* (Venezuela), 1971, **21**, 449–464; through *Hort. Abs.*, 1972, **42**, 827. Three rates of N, P_2O_5 and K_2O were applied to a 3-harvest crop of sugar cane (variety B 4362) on a Rodeo soil high in K but low in N and P. The best results were obtained with N at 150, P_2O_5 at 75 and K_2O at 200 kg/ha at planting, and N at 150 and K_2O at 200 kg/ha after plant cane and first ratoon harvests, respectively. The response to K was not in agreement with previous results.

* * *

Differential effect of organomercurial compounds on the germination and yield of sugar cane. O. SINGH, C. N. BABU and K. P. SHARMA. *Ind. J. Agric. Research*, 1971, **5**, (1), 38–40; through *Hort. Abs.*, 1972, **42**, 828. Cane germination and yield were enhanced by dipping setts in 0·5% "Agallol", "Tafasan" or "Merculine" before planting. "Hexasan" at 0·5% was considerably less effective.

* * *

Effects of some agro-chemicals on sugar cane. C. N. BABU, S. P. JAISWAL, R. S. KANWAR, R. P. CHAWLD and R. C. KATARIA. *Ind. J. Agron.*, 1970, **15**, 160–165; through *Hort. Abs.*, 1972, **42**, 829.—Pre-planting treatment of cane setts with 0·5% "Agallol" solution plus soil treatment with 10% BHC dust or 15% "Telodin" emulsion or 20% gamma-BHC emulsion improved germination, reduced *Chilotraea infuscatella* attack and increased yields. The insecticidal treatments improved nutrient uptake and offset the reduction in juice quality caused by nitrogen application, but these trends were not statistically significant.

Abscisic acid in immature apical tissue of sugar cane and in leaves of plants subjected to drought. B. H. MOST. *Planta*, 1971, **101**, (1), 67–75; through *Hort. Abs.*, 1972, **42**, 830.—Abscisic acid was extracted from immature leaf and stem tissue of sugar cane. Mature leaves of well-watered plants only contained traces of it, but plants subjected to drought accumulated relatively large amounts in their mature leaves. Extracts from wilting leaves contained a substance similar to or identical with (+)-phaseic acid.

* * *

Note on the effect of CCC on germination and shoot: root ratio of sugar cane setts. R. B. R. YADAVA. *Indian J. Agric. Sci.*, 1971, **41**, 638–639.—CCC (2-chloroethyl trimethylammonium chloride) or chlorocholine chloride, a growth retarding chemical, produces effects different from those produced by gibberellic acid. In the experiments reported one-budded sugar cane setts were pre-soaked in different concentrations of the chemical (10, 100 and 1000 ppm) for 24 hr. Results did not indicate that CCC has a stimulatory effect on germination. However, 10 and 100 ppm of the chemical significantly increased the shoot:root ratio of sugar cane setts.

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Aerobiology of *Cercospora koepkei* causing the yellow spot disease of sugar cane. T. SREERAMULU, B. P. R. VITTAL and V. RAMAKRISHNA. *Indian J. Agric. Sci.*, 1971, **41**, 655–662.—Variations in the intensities and periods of outbreak of yellow spot disease in relation to the conidial concentrations of *Cercospora koepkei* in the air within and above the crop in plots planted with setts of Co 419 variety of sugar cane in March 1966 and 1967 at the Sugarcane Research Station, Anakapalle, were examined and related to the prevailing weather conditions. The importance of atmospheric humidity on the intensity of outbreak of the disease in any year and the rôle of collateral hosts in the carry-over of the fungus were indicated. A forenoon pattern of diurnal periodicity in the conidial catches was recorded. The optimum ranges of temperature and relative humidity at which conidia of *C. koepkei* were abundant in the air were 18–28°C and 40–90% respectively. The fungus could survive from one season to the next on plant material other than sugar cane, as it can infect grasses and wild sugar cane.

* * *

Sugar cane gummosis (in Mozambique). M. E. PINTO and M. DE MENDONÇA. *Agronomia Moçambigana*, 1972, **6**, 143–147.—This troublesome bacterial sugar cane disease (*Xanthomonas vasculorum*) has now been recorded in southern Mozambique. Colour photographs show results of artificial inoculations. It is proposed to study the possibility of different strains present in Mozambique.

* * *

Ferric dimethyl dithiocarbamate ("Ferbam") as a sugar cane sett protectant. K. SINGH, K. C. ALEXANDER and T. R. BUDHRAJA. *Indian Phytopathology*, 1971, **24**, 640–643.—Pre-plant sett protective activity of 20 fungicides was tested. Of these, "Ferbam", "Thiram" and "Captan" showed promise in the preliminary screening in comparison with "Aretan" (0·01%) in the number of millable canes, weight of cane and germination. It is therefore concluded that "Ferbam", at 0·75% concentration, can be used as a substitute for the conventional mercurial fungicides.

* * *

A new record of sugar cane infestation with *Chilo agamemnon* in southern Assiut and Suhag (Egypt). A. L. ISA and W. H. AWADALLAH. *Agric. Research Rev.* (Cairo), 1972, **50**, (1), 49–50.—Results of a survey are given to ascertain the prevalence of this sugar cane borer. Infestation varied from 5% to 100%. It is thought that recent changes or increases in prevalence may be associated with changes in irrigation practice. The borer *Sesamia cretica* may also be troublesome.

* * *

A standard technique for rearing *Chilo agamemnon* on an artificial diet. A. L. ISA. *Agric. Research Rev.* (Cairo), 1972, **50**, (1), 61–64.—A laboratory method of rearing larvae of this sugar cane borer is described. Ingredients of the artificial diet were agar, cellulose, glucose, sucrose, casein, yeast extract, ascorbic acid and rice bran. "Methyl-Paraben" and sorbic acid were added to prevent spoilage. Rearing was done individually in vials at a constant temperature of 27°C. About 80% of the larvae pupated. The pupae obtained were large and healthy and gave rise to fertile moths.

* * *

Response of sugar cane to NPK under Ludhiana (Punjab) soil conditions. O. SINGH, H. S. GILL, G. SINGH and C. N. BABU. *J. Research Punjab Agric. Univ.*, 1971, **8**, (3), 299–303; through *Biol. Abs.*, 1972, **54**, 5097.—N application resulted in a significant increase in cane yield. A dose of 169 kg/ha seemed to be the optimum dose for the loamy sandy type of soil. It gave 785 quintals of stripped cane/ha against 600 quintals from the control. Cane yield beyond this level of N application remained unchanged. P_2O_5 at 84 kg/ha resulted in an average of 5% increase in cane yield. The effects due to K application were insignificant.

* * *

Occurrence of similar particles in Fiji disease virus-infected sugar cane and insect vector cells. R. I. B. FRANCKI and C. J. GRIVELL. *Virology*, 1972, **48**, (1), 305–307; through *Rev. Plant Pathology*, 1972, **51**, 744. The virus-like particles of *ca.* 70 nm dia. with cores *ca.* 40 nm found in the galls caused by sugar cane Fiji disease virus were also present in *Perkinsiella saccharina* (bred on infected sugar cane) in quantities suggesting that the virus is able to multiply in the vector.

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Trial comparing several herbicides, pre-emergence, in sugar cane in Lima, Peru. O. S. UGAZ and P. J. ESPINOZA. *Resumenes de Trabajos, la Reunión de Trabajo de la Asociación Latinoamericana de Especial-*

istas en las Ciencias aplicados a las Malezas (ALAM), 1971, 22; through *Weed Abs.*, 1972, **21**, 212.—Satisfactory control of *Euphorbia heterophylla*, *E. hirta* and *Eleusine indica* in sugar cane was obtained with "Sencor" at 2 and "Tribunil" at 4 kg/ha.

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Rooting characteristics and varietal tolerance of sugar cane to "Diuron". S. Y. PENG and H. J. YEH. *Weed Res.*, 1971, **11**, (2/3), 135–142; through *Weed Abs.*, 1972, **21**, 212.—The relative susceptibility of 6 commercial sugar cane varieties, previously ascertained, was confirmed. A significant correlation was found between the rooting characteristics of these varieties and their susceptibility to "Diuron" at 10 kg/ha. The more susceptible varieties were found to produce larger sett roots and smaller shoot roots, both of which also tended to be more easily injured by "Diuron". The root injury appeared as "burnt" root tips resulting from contact with the layer of soil treated with herbicide. The roots of tolerant varieties seemed to be immune to such injury and continued growing after penetrating the contaminated soil layer. Uptake of "Diuron" through side shoots of the susceptible variety F 156 resulted in 68·5% growth retardation.

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Translocation of ^{14}C in sugar cane plants supplied with or deprived of phosphorus. C. E. HARTT. *Plant Physiology*, 1972, **49**, 569–571; through *Soils and Fertilizers*, 1972, **35**, 596.—Sugar cane plants were grown in nutrient solutions containing 0, 2 and 32 mg/litre P. ^{14}C-translocation was impaired by P deficiency in only one sugar cane variety (H37-1933) of the three tested. P deficiency decreased the inorganic P % more than it decreased the organic P%. This small effect of P deficiency on phosphorylation was not sufficient to affect translocation.

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Field experiments on the chemical ripening of sugar cane in Jamaica and Belize in 1970. R. A. YATES. *Trop. Agric.* (Trinidad), 1972, **49**, 235–244.—See *I.S.J.*, 1973, **75**, 198–203.

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New cane varieties have performed well. ANON. *Producers' Rev.*, 1972, **62** (4), 19.—New sugar cane varieties recently released in Queensland and the areas or districts concerned are named. Q 94 was selected in the central district where it is capable of producing heavy erect crops on alluvial soil where other varieties lodge and is suited to the better class alluvial soils where it is likely to replace, to some extent, Q 73, Q 68, and Q 63. Q 95 was selected for the Isis area where it is suitable to the medium- and better-class red volcanic soils but not to the poorer eroded sections.

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Leaf scald research. ANON. *Producers' Rev.*, 1972, **62**, (4), 19–21.—Recent research has shown that certain grasses may harbour the organism responsible for the disease and so act as reservoirs of the disease between outbreaks in sugar cane. Blady grass, common in most parts of the Queensland cane belt, has been proved to be a natural carrier of the disease. It seems that at least two other grasses, *Paspalum conjugatum* and *Brachiaria piligera*, can also act as hosts of the disease in the field. Different strains of the causal bacterium have been found to react with different cane varieties in different ways, but the organism remains infective for only a day or so when added to soil. The disease can be spread by flies under given conditions, but the climbing rat (*Melomys littoralis*) is not an efficient transmitter.

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New cane varieties sought for wet belt. ANON. *Producers' Rev.*, 1972, **62**, (4), 33.—There has been a big change in the varieties grown in the northern wet belt of Queensland during the last decade. Ten years ago the dominant variety was Q 57. It contributed 33–34% of the crop, followed by Badila (33%) and Pindar (18%). Last year the dominant varieties were Q 83 (42%), Q 82 (20%) and Q 57 (18%).

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Establishment of the sugar cane borer egg parasite *Telenomus alecto* in India. K. L. KAMAT, K. R. NAIR and S. K. PRADHAN. *Indian Sugar*, 1972, **21**, 743–749. Experiments on parasitism of *Chilo infuscatellus* eggs by *Telenomus alecto*, a few eggs of which were imported into India from Colombia, are reported. Considerable evidence was found of competition between *T. alecto* and another borer parasite, *Trichogramma australicum*, which has tended to prove more "flexible" than the former. However, *T. alecto* has added to the aggregate parasitism of *C. infuscatellus* eggs and its introduction is therefore considered useful. The biology, immature stages, distribution and occurrence in India are also discussed.

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Effect of differential fertilization on yield of sugar cane crops in the soils of Uttar Pradesh. M. P. SINGH and K. N. TIWARI. *Indian Sugar*, 1972, **21**, 751–752. Fertilizer trials on cultivators' fields (considered more representative than at experiment stations) indicated that the highest yield of cane was obtained by application of 120, 50 and 60 kg/ha, respectively, of nitrogen, phosphorus and potassium. The yields obtained with other quantities and combinations as well as the individual fertilizers on their own are also recorded.

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Performance of certain foreign sugar cane varieties under Karnal conditions. C. N. BABU and P. SANKARANARAYANAN. *Indian Sugar*, 1972, **21**, 753–757.—In this paper the the performance of 10 foreign varieties on trial at the Sugarcane Substation, Karnal, is discussed. Eight of the varieties were from the US (CP) and two from Barbados (B). Brief notes are given on each variety.

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Sugar industry in Madhya Pradesh. H. K. SHRIVASTAVA. *Indian Sugar*, 1972, **21**, 795–801.—Various aspects of the sugar industry in the State are discussed.

Increased irrigation facilities are considered to be the most important need of the industry. Better disease-free seed cane is another urgent need. Government seed farms could be established for this purpose.

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Response of sugar cane to N-P-K fertilizers. B. K. MATHUR. *Indian Sugar*, 1972, **21**, 809–815.—Fertilizer experiments involving numerous different treatments are recorded. Included also are observations on germination, tillering ability, yield of millable canes, juice quality and sugar yield. It was found that application of fertilizers did not affect germination and that P addition was particularly desirable when the higher levels of N were applied. Increase in the level of N from 75 kg to 225 kg/ha simultaneously increased tiller production.

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Sugar cane borers at Cuddalore (Tamil Nadu). G. VARADHARAJAN *et al. Indian Sugar*, 1972, **21**, 817–820. Results are given of observations on three cane borers destructive to cane in Tamil Nadu and of attempts made to correlate their activities with weather conditions. The three borers were: the shoot borer, *Chilo infuscatellus*, the top borer *Tryporyza nivella* and the internode borer *Chilo indicus*. It was found that all three borers are active during the hot months, when the temperature is high and there is low humidity. They are not active during the rainy season when the temperature is lower and there is heavy rainfall and high humidity.

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A study on *Mutumuratettix hiroglyphicus* Matsumara in Taiwan. H. L. YANG and J. S. PAN. *Taiwan Sugar*, 1971, **13**, 243–246; 1972, **14** 28–30, 63–64.—The morphology of the adult and nymphal stages of *Mutumuratettix hiroglyphicus*, earlier established as the principal vector of white leaf disease in Taiwan, is presented as well as details of the insect's life history distribution and seasonal history.

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Parasites and predators recorded on insect pests of sugar cane in India. D. K. BUTANI. *Indian Sugar*, 1972, **22**, 17–31.—A brief account is given of attempts at biological control of sugar cane pests in India. This is followed by a long list of known parasites and predators of cane pests.

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Two new cane planters. ANON. *Australian Sugar J.*, 1972, **64** 59–60.—Two new cane planters are briefly described and illustrated with photographs. They are the "Don 275" and an automatic double-row cane planter developed to plant cane setts harvested with a chopper harvester. The "Don 275", expected to be released for general sale in 1973, is a small compact planter unit carried on the 3-point linkage of a tractor. A trailer carries the cane laid horizontally. The operator sits on the trailer and slides the stalks forward into the unit.

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Red stripe disease. J. DELGADO and M. ABARCA. *Bol. Azuc. Mex.*, 1972, (265), 5–10.—A description of this disease, caused by *Xanthomonas rubrilineans* and widely distributed in cane-growing countries, is given. Its significance in Mexico is discussed and a list given of susceptible, resistant or fairly resistant sugar cane varieties.

* * *

Controlling Johnson grass and Raoul grass on ditch banks in the Louisiana sugar cane areas, 1972. ANON. *Sugar Bull.*, 1972, **50**, (17), 7.—Foliar applications of either MSMA (monosodium methane arsonate) or "Dalapon" will control Johnson grass on ditch banks. Bermuda grass usually colonizes eventually after MSMA and various broad-leafed weeds and vines after "Dalapon". The former may be preferred in limiting soil erosion and limiting reinfestation from Johnson grass seedlings. Two or four applications of MSMA or "Dalapon" may be needed in the first year and two in the second year. To control Raoul grass, plants should be sprayed with MSMA when they are approximately 2 ft tall and before the seed matures, respraying being done when necessary during the growing season to control new plants.

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Sugar cane varieties (in Réunion). J. FRITZ. *Rpt. Inst. Recherche Agron. Trop. Réunion*, 1971, 15–16. Results showed that of the 6 varieties planted in 1967, the 3rd ratoons (cut in October 1971) of R 526 gave the highest sugar yield (5·7 tons/ha), followed in descending order by M 63/69, R 472, R 464, R 512 and S 17.

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Uptake of minerals by sugar cane (in Réunion): 1970 results. J. FRITZ. *Rpt. Inst. Recherche Agron. Trop. Réunion*, 1971, 17–18.—Results are given of tests in which dried cane pulp samples were analysed for nitrogen, phosphorus, potassium, calcium, magnesium, sodium and sulphur and the findings related to the uptake in kg/ha.

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Results of fertilization tests in the 1971 campaign (in Réunion). J. FRITZ, G. LOYNET and H. DE FRAISSE. *Rpt. Inst. Recherche Agron. Trop. Réunion*, 1971, 19–40.—Full details are given of N-P-K trials, with the recommended application for maximum yield at three locations.

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Combating cane borers. J. ETIENNE. *Rpt. Inst. Recherche Agron. Trop. Réunion*, 1971, 45–56.—Tests in which *Lixophaga diatraeae*, a parasite of the borer *Chilo sacchariphagus*, was bred on an alternative host, *Galleria mellonella*, showed that the parasite suffered progressive diet deficiency during its endophagous stage, which had an adverse effect on the mating habits of the male and reduced the fertility of the female compared with the situation using its normal host. However, promising results have been obtained in the breeding of *Trichospilus diatraeae*, a parasite of *C. sacchariphagus* and *Sesamia calamistis*, another borer attacking cane in Réunion. Tests with *Pediobius furvus* gave poor results because of lack of supplies of *S. calamistis* larvae, while *Tetrastichus* sp. suffered

greater losses in breeding on *G. mellonella* than did *T. diatraeae*.

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Cane gummosis (in Réunion). B. RAT. *Rpt. Inst. Recherche Agron. Trop. Réunion*, 1971, 57–71.—Studies on the causal agent, *Xanthomonas vasculorum*, on cane gumming disease are reported. From 292 strains obtained from the cane-growing area of Réunion, 13 types have been identified from their reaction to antibiotics and 10 lysotypes using 16 bacteriophages. No correlation was found between the wide variation in bacteria and breeding location or disease varieties.

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Effect of "Cycocel" on ripening of sugar cane. S. C. SRIVASTAVA, B. SINGH and K. SINGH. *Proc. 4th Joint Conv. Indian Sugar Tech. Assocs.*, 1971, A.1–A.7. "Cycocel" or "CCC" (2-chloroethyl trimethyl ammonium chloride) is known to produce unusual and varied responses in a number of plants. It was tried as a cane ripener in Hawaii in 1967. This investigation was intended to investigate its possibilities as a cane ripener under the conditions of the south-east coastal region of southern India where ripening of cane is rather slow. The quality of the juice of the variety used (Co 6314) was improved by "Cycocel" spray, but more extensive trials are needed with different cane varieties and at different times.

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Observations on survival and dispersal of *Pyrilla* in relation to foliar density of sugar cane during hot weather. K. M. GUPTA, N. L. SINGH, R. DYAL and I. SINGH. *Proc. 4th Joint Conv. Indian Sugar Tech. Assocs.*, 1971, A.9–A.11.—It is known that several factors may influence intensity of attack of *Pyrilla perpusilla*. Experiments are reported concerning effects of irrigation (in promoting growth) and foliage density on populations, and concerning migration habits. Populations increased with foliage density and there was virtually no migration in the first brood from a poor to a luxuriant crop and *vice versa*, but in the second brood there was migration when the maximum temperature ranged from 24·9°C to 36·0°C. It was concluded that control of *Pyrilla* should be accomplished in its first brood, during April–May, and special attention be paid to crops showing luxuriant growth.

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Assessment of loss in sugar cane yield and sugar recovery at different levels of termite attack. K. M. GUPTA and R. A. SINGH. *Proc. 4th Joint Conv. Indian Sugar Tech. Assocs.*, 1971, A.13–A.18.—Results of trials are given which were carried out over two seasons at Shahjahanpur to assess damage to cane by termites in terms of monetary value. Of seven species of termite in the area, *Microtermes obesi* was the commonest. Setts, canes, trash and stubble all constitute food for termites and this accounts for the high incidence of termites in cane in many areas. They may attack eye buds causing poor germination. Constant nibbling of the roots causes poor growth, yield and sugar content. Stalks become liable to lodge. Stalks may be tunnelled and filled with mud, causing milling complications. Termite damage varies greatly in different localities or fields and in different seasons. A rough estimate of the damage in the area concerned was 5–13 kg sugar for every 10 tons of cane crushed.

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A new record of *Telincane paria* on sugar cane in Haryana. O. P. SINGH and R. B. MATHUR. *Proc. 4th Joint Conv. Indian Sugar Tech. Assocs.*, 1971, A.19–A.20.—The attack by this weevil and the damage to cane leaves was severe. There appeared to be no preference for different sugar cane varieties. Another weevil found in association with it and also attacking sugar cane was a species of *Myllocerus*.

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Resistance of some promising cane varieties to red rot in Uttar Pradesh. K. KAR, S. C. GUPTA and G. P. SINGH. *Proc. 4th Joint Conv. Indian Sugar Tech. Assocs.*, 1971, A.21–A.24.—Results are given of screening work with numerous cane varieties and their resistance to red rot disease (*Glomerella tucumanensis*). The period 1966–1971 is covered. Varieties are classified as susceptible, moderately resistant and resistant. Resistance is not necessarily associated with good agronomic characters. The varieties found to be fairly resistant can be selected if they are found satisfactory in yield and recovery as judged by production of sugar per acre. Keeping in view the different attributes, the outstanding varieties released for general cultivation in the central tract were Co 1148, Co 1158, Co 1336, Co 62035 and CoS 611.

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A note on the susceptibility to rust of a few promising sugar cane varieties and the influence of climate. N. B. SHAIKH and V. V. SHINGTE. *Proc. 4th Joint Conv. Indian Sugar Tech. Assocs.*, 1971, A.25–A.30.—Sugar cane is an important crop in Maharashtra where it may suffer from rust (*Puccinia*). An account is given of variety trials to test susceptibility. Out of 49 varieties tested, 18 were found to be susceptible and 31 varieties remained free of the disease. Co 419 and Co 740, among the released varieties, did not show infection at any stage of crop growth. Even though Co 775, Co 798, Co 853 and Co 678 were found to be susceptible, the incidence of the disease was very low. The occurrence of rust was much lower in 1956–66 than in the period 1960–64 because of low humidity, higher temperature and bright sunshine.

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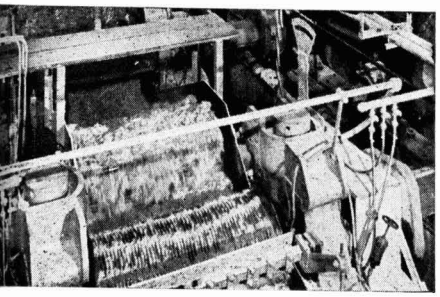
An assessment of the effect of date of planting on the incidence of pest attack and on juice quality. G. V. PHADKE, S. T. PATIL and G. K. ZENDE. *Proc. 4th Joint Conv. Indian Sugar Tech. Assocs.*, 1971, A.31–A.43.—In Maharashtra, sugar cane may be planted at three different seasons, described as "adsali", "preseasonal" and "suru". Trials were carried out for three seasons at Padegaon to study date of planting in regard to the incidence of certain pests, especially borers, as well as the effect on juice quality, if any. Planting date had no constant effect on germination, but borer incidence was affected. The adsali crop suffered most from scale insect attack and this affected juice quality. Early planting in each season gave the best quality juice.



Cane sugar manufacture

Polish export of cane sugar factories and its prospects. S. GIELZYŃSKI. *Gaz. Cukr.*, 1972, **80,** 179–182.—Cane sugar factories supplied by Poland and briefly described include: Bei Tse (China), Van Diem (North Vietnam), Akuse (Ghana), Bahawalnagar (Pakistan) and Tjot Girek (Indonesia).

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Application of statistical control of quality to fix the date of starting and ending the harvest. L. CASTAÑEDO B. *Bol. Azuc. Mex.*, 1972, (267), 15–20.—Examples of data and calculations are given whereby weekly analysis can indicate whether cane is suitable for cutting or if the juice produced is not of acceptable minimum purity.

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Mechanization of harvesting and its effects on cane quality (Cuba: 1964–1968). A. F. BETANCOURT. *Bol. Azuc. Mex.*, 1972, (265), 15–22, (266), 14–21, (267), 21–29.—See *I.S.J.*, 1973, **75,** 53.

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Reviewing 10 years of experience with the DDS cane diffuser at Tanganyika Planting Company. G. VAN DER WOLF. *Sugar y Azúcar*, 1972, **67,** (7), 17–18, 24.—See *I.S.J.*, 1972, **74,** 359–361.

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Magnetic separation of tramp iron from sugar cane at the mill. ANON. *Sugar y Azúcar*, 1972, **67,** (7), 19–20.—Information is given on tramp iron magnetic separation devices installed at various cane sugar factories, and brief mention is made of the considerably smaller problem of iron separation in refineries.

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A simple automatic feed device for multiple-effect evaporators. G. K. CHETTY. *Sugar y Azúcar*, 1972, **67,** (7), 21–22.—An automatic juice level regulator, consisting basically of a plunger valve in a tube, is described. With inadequate evaporation, juice flows from the evaporator effect into the tube and via the valve to the clear juice tank.

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Processing sugar cane and sugar beets in the same factory. G. F. LODI. *Sugar y Azúcar*, 1972, **67,** (7), 23–24.—Details are given of equipment and processes used at Calnu sugar factory in Uruguay which was built by Soc. Fives Lille-Cail for cane crushing from July and beet processing from November. The double carbonatation process is used. Some performance data are given for the 1971 cane season.

Evaluation of continuous centrifugals for *C*-massecuites. L. GONZÁLEZ P. and O. L. GARCÍA H. *Cuba-Azúcar*, 1972, (April/June), 2–10.—A series of trials were made during the 1971 season on continuous centrifugals for *C*-sugar at a Cuban factory, varying a number of parameters (massecuite flow, wash water volume, mother liquor viscosity) and observing the results (sugar purity, molasses purity, power consumption). A regression equation was developed relating sugar purity to massecuite purity, water usage, massecuite flow rate and mother-liquor viscosity. Breakage of crystals is the major disadvantage of the continuous machine and is illustrated by a photograph and by comparative size distribution curves. Increased molasses purity is the second disadvantage and amounted to 0·66 points between 1970 and 1971. The authors believe, however, that with proper attention to massecuite temperature, high throughput and high sugar purity can be achieved without an increase in molasses purity.

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"Pablo Noriega" experimental unit. G. GONZÁLEZ. *CubaAzúcar*, 1972, (April/June), 16–22.—An account is given of the unit at this factory which, since 1971, has been devoted to the carrying out of experimental work on a full scale, permitted by its 875 t.c.d. capacity and 2000 ha of cane fields. Research already carried out has covered studies on plantation white sugar manufacture, the influence of burnt cane on processing, juice demineralization by ion exchange, the influence of lime quality on evaporator and heater scaling, use of locally-produced polyelectrolytes, lime-sucrose-CO_2 complex usage, inhibition of colour formation in sugar stored in bulk, etc.

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Industrial behaviour of burnt cane. ANON. *Cuba-Azúcar*, 1972, (April/June), 33–42.—Studies were made at the "Pablo Noriega" Experimental Unit in 1971 to determine the effects of crushing only burnt cane. In general there was little effect on the normal process, but the work cycle of the evaporators was shortened and there were higher sugar losses in bagasse and molasses; nevertheless sugar yield was higher than expected. The results were not definitive, however, as a consequence of the extremely dry conditions experienced during the year.

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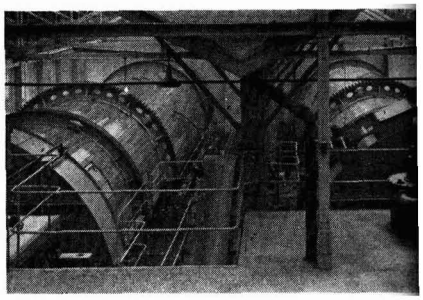
Cane juice acidity *vs.* sugar recovery. J. C. P. CHEN and R. W. PICOU. *Sugarland* (Philippines), 1972, **9.** (1, 2, 3), 20, 57–59.—See *I.S.J.*, 1973, **75,** 116.

Beet sugar manufacture



Effect of beet quality, storage methods and processing on undetermined sugar loss in the factory. A. YA. ZAGORUL'KO, S. A. BOGDANOV and T. P. KHVALKOVSKII. *Sakhar. Prom.*, 1972, (7), 21–25.—Chief sources of undetermined losses in carbonatation, evaporation and boiling are discussed and regression equations derived for their calculation in evaporation and boiling in terms of temperature, residence time and pH. A computer programme for calculation of optimum pH in these processes is also presented.

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The temperature field in massecuite boiling in tubes. V. I. PAVELKO and V. T. GARYAZHA. *Sakhar. Prom.*, 1972, (7), 24–28.—From studies of temperature change in massecuite of given Brix during boiling in a vertical brass tube it is concluded that high-purity massecuite should be boiled at 70–80°C; at 80°C overheating of the massecuite adjacent to the tube wall takes place, the thickness of the layer decreasing with movement of the massecuite up the tube. At higher temperatures sucrose decomposition and colour increase.

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Fine and special steels: the viewpoint of users in the sugar industry. M. LE BLANC. *Ind. Alim. Agric.*, 1972, **89**, 859–860.—The manager of Roye sugar factory in France reports on the various types of steel used in his factory and of wear problems and failures encountered with different pieces of equipment as a result of the corrosive or abrasive nature of the media being handled.

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Microbiological investigation of flume water treatment. L. VOKOUNOVÁ. *Listy Cukr.*, 1972, **88**, 131–137. Various methods of flume water treatment were examined at five different sugar factories and the bacterial counts in processes using the treated water determined. Comparison of the results indicates that the best bacteriological condition of the water is obtained primarily by making alkaline before settling and chlorinating after settling. In addition, disinfection of the beet after washing is recommended in order to avoid secondary infection from the recycled water.

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Conductimetric indication of 1st carbonatation juice alkalinity. V. HRDLIČKA and V. VALTER. *Listy Cukr.*, **88**, 138–140.—Details are given of a conductimetric system applied to 1st carbonatation juice which in factory tests accurately registered changes in alkalinity of $\pm$ 0·01% CaO.

Sugar beet storage. H. J. DELAVIER. *Zeitsch. Zuckerind.*, 1972, **97**, 431–434.—After examining the question of determining beet condition before storage and the effect of varietal and agricultural factors on storage properties, the author briefly outlines methods of reducing storage losses.

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Sugar factory waste water and pollution. E. MARIANI. *Ind. Sacc. Ital.*, 1972, **65**, 59–66.—The author, having emphasized the small contribution of sugar factory waste water to pollution in general, reviews the most modern methods for treatment of water to give acceptable characteristics. The most important means are biological treatments employing different types of beds, including activated sludge and percolation beds. Stabilization lagoons and irrigation systems are described and the problems given by waste water from ion exchange plants are discussed.

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Heat transfer during boiling of water and sugar solutions flowing as a film along horizontal tubes. I. I. SAGAN' and V. A. KARAS'. *Izv. Vuzov, Pishch. Tekh.*, 1972, (2), 113–116.—Heat exchange was greater when sugar solution was boiled during film flow along the outside of horizontal tubes than with flow inside vertical tubes or in the juice space of a vessel under optimum hydrodynamic conditions. Heat exchange decreased with rise in concentration and fall in pressure.

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Xanthi sugar factory in Greece. J. KRASIŃSKI. *Gaz. Cukr.*, 1972, **80**, 163–168.—Details are given of equipment and processes at Xanthi sugar factory which was planned to start operations in September 1972. The factory is designed for a daily slice of 3000 tons of beet/day, with a possibility of expansion to 5000 tons/day.

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Sugar factories and refineries exported by Poland. Z. NITSCHKE. *Gaz. Cukr.*, 1972, **80**, 169–174.—The processes used at Hrochuv Tynec and Hrušovany sugar factories (Czechoslovakia), Mosul (Iraq) and Xanthi (Greece), all of which produce white sugar from beet, are outlined, particularly the boiling schemes used.

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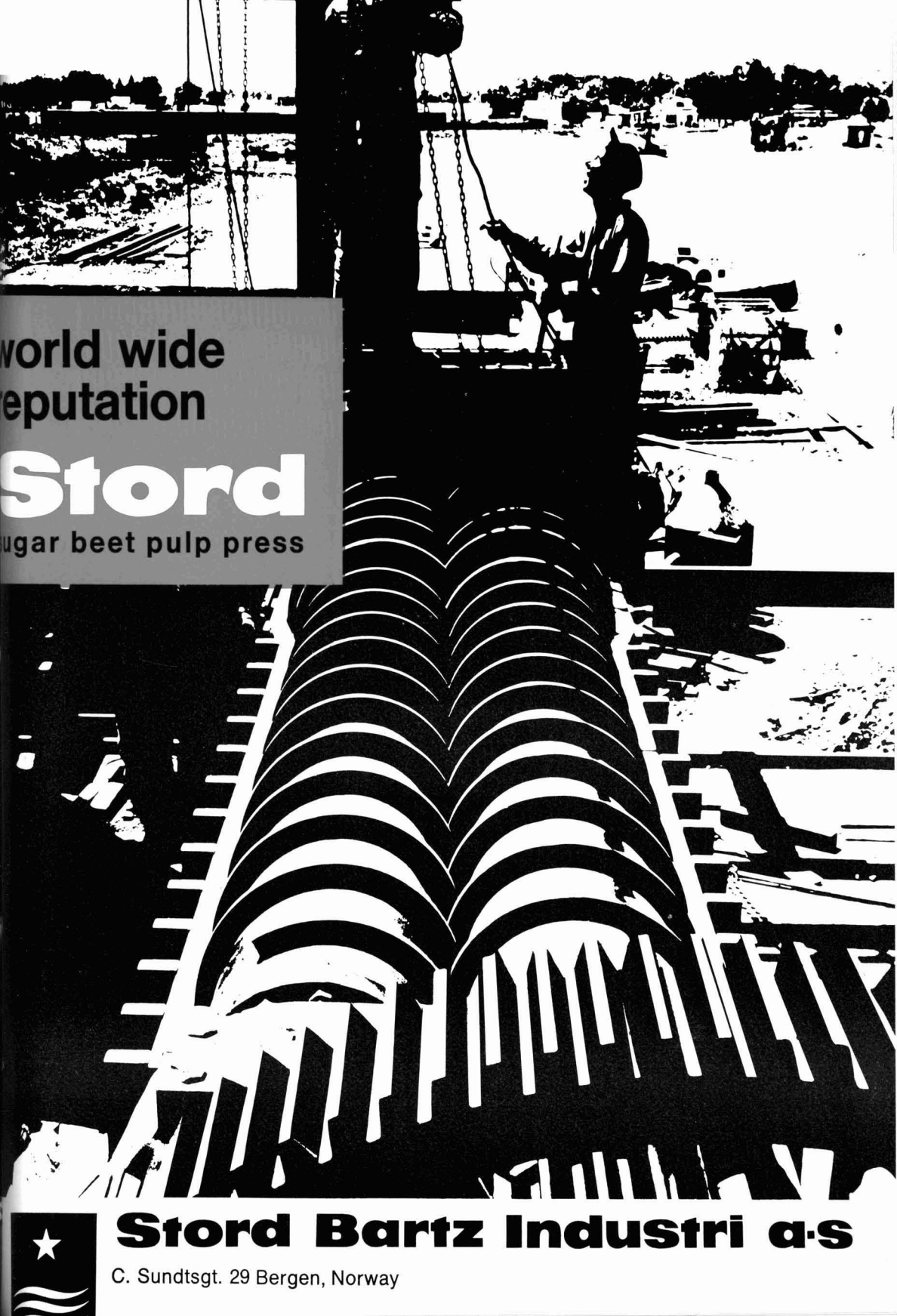
Modernization and expansion of the diffusion station at East German sugar factories. W. JASZCZYŃSKI. *Gaz. Cukr.*, 1972, **80**, 175–178.—Information is given on the installation of Polish-built DDS diffusers at 19 East German sugar factories.



Stord Bartz Industri a·s

C. Sundtsgt. 29 Bergen, Norway

Energy production in the export of Polish sugar factories. W. FACHINETTI. *Gaz. Cukr.*, 1972, **80**, 183–186.—Steam- and electrical power-generation plant installed in beet and cane sugar factories supplied by Poland is described.

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Molasses desugaring in sugar factories supplied by Poland to Iran. A. KREMKY. *Gaz. Cukr.*, 1972, **80**, 187–189.—Information is given on the Steffen process used at Iranian beet sugar factories supplied by Poland and a letter is reproduced indicating a yield of 82–83% of the sugar in molasses at a daily throughput of 40 tons during the first month of operation in 1962 (*sic*).

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Heat economy of a sugar factory with a quintuple-effect evaporator. S. ZAGRODZKI. *Zucker*, 1972, **25**, 519–527, 560–568.—The basic theory of the heat exchange process in evaporation is briefly explained and the approach to establishing an optimum heat balance for a sugar factory demonstrated. The quantities of water, sugar, solids and non-sugars obtained from 1 ton of cossettes in every process from diffusion to final molasses are tabulated (including the quantities involved in 1st carbonatation mud sweetening-off and milk-of-lime preparation) and the heat balances detailed for each process. A Sankey diagram is reproduced showing the solids balance for the processes. The heat balance of a quintiple-effect evaporator is then set out for each effect and expressed as a Sankey diagram. It is stated that beet washer operation will govern juice quality and steam consumption; that juice concentration is decisive for steam and heat consumption and should ideally be brought to 70% solids in evaporation; that heat consumption in individual processes can be considerably reduced by lowering the temperature in juice purification, particularly 2nd carbonatation, thus minimizing heat losses in filtration; that an efficient condensate economy is necessary in every sugar factory, with successive condensate expansion and use for juice heating, but SO_2 or chlorine should be added to cooled condensate before use in diffusion, and the condensate should not be mixed with other waters; and that as little juice as possible should be recycled to process and filter-thickeners should be used.

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Use of turbo-aerators for waste water treatment. F. KASTNER. *Listy Cukr.*, 1972, **88**, 159–166.—Turbo-aerators for waste water treatment in activation ponds are surveyed and individual phases of aerobic activation described. The costs of three different systems are briefly set out.

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Effect of the construction of mechanical diffusers on the water economy of a sugar factory. J. HERCÍK. *Listy Cukr.*, 1972, **88**, 187–191.—The considerable effect on sugar factory water economy and waste water disposal exerted by continuous diffusers under Czechoslovakian conditions is discussed in relation to river pollution and use of land for effluent treatment and the benefits brought about by replacement of batch with continuous units indicated.

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Planning and construction of Offenau sugar factory owned by Süddeutsche Zucker-AG. H. HAESELER. *Zucker*, 1972, **25**, 581–601.—Planning and construction of Offenau white sugar factory, which has a daily slice of 6000 tons of beet and started operations in September 1971, are described with the aid of photographs and details given of the equipment and processes used.

* * *

Sugar loss through hyperthermophilic micro-organisms in beet sugar factory diffusers. H. KLAUSHOFER and G. POLLACH. *Zucker*, 1972, **25**, 602–609.—Losses in diffusion calculated from a fall in pH alone may not represent total microbial losses since inversion may also be caused by thermophilic micro-organisms without any acid production. However, such infections are rarely observed in practice, and from a number of strains only one was found which formed "exo-invertase" to any great extent. Where hyperthermophilic bacteria cause formation of H_2S, additional loss of sugar through inversion is not to be expected. It is concluded that optimum disinfection of a diffuser must be calculated for each individual case and set of circumstances.

* * *

Criteria of selection of sugar factory equipment. J. DOBRZYCKI. *Gaz. Cukr.*, 1972, **80**, 193–196.—The criteria to apply in the choice of equipment are discussed under: type of investment, quality of product given by the equipment, operating costs, ease of use and maintenance, and reliability. Advantages of continuous machinery over batch equipment are stated.

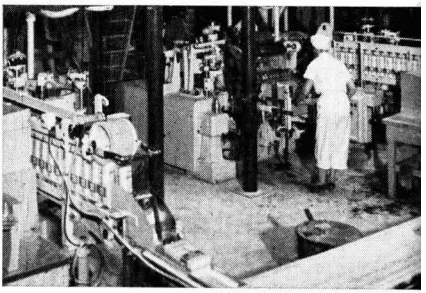
* * *

Non-sugars after preliming and precarbonatation of raw juice. S. ZAGRODZKI and K. SZWAJCOWSKA. *Gaz. Cukr.*, 1972, **80**, 197–199.—See *I.S.J.*, 1972, **74**, 117.

* * *

Addition of raw cane sugar to the beet sugar manufacturing process. G. GARCIA. *Ind. Sacc. Ital.*, 1972, **65**, 103–107.—During the 1972 campaign in Chile, experiments were made in which raw cane sugar was dissolved in raw beet juice prior to its purification by the normal carbonatation process. The juice Brix was increased and this resulted in a decrease in its filtrability and settling while the colour of the thin juice produced also tended to rise with raw juice Brix but not in a definite manner. About 80% of the raw sugar colour was removed by the process, which avoided the use of affination, machinery for which is not generally available in the beet sugar factory. White sugar quality was not affected while little additional fuel was needed.

Laboratory methods & Chemical reports



Effect of sucrose and other oligosaccharides on reducing sugar determination in very alkaline copper solution. D. BOURDON. *Ind. Alim. Agric.*, 1972, **89**, 1009–1012. Methods of determining reducing sugars are surveyed, particularly those of SAILLARD and BERTRAND. The latter method was used in tests to determine the effect of sucrose and other oligosaccharides, in which a large excess of sucrose caused an error of as much as +32%. To avoid this, the author recommends semi-micro methods such as those of SOMOGYI and PLUMEL which give a maximum error of ±3% when 100 parts of sucrose are present with 1 part of reducing sugar.

* * *

Determination of conductimetric purity of factory sugar solutions. V. VALTER. *Ind. Alim. Agric.*, 1972, **89**, 1015–1019.—Tests are reported in which a linear regression was found between purity and maximum electrical conductivity for sugar solutions in the purity range 65–95. The measurements were made at 20°C (at which the Brix should be 28 ± 2°); the readings increased with temperature, so that at 80°C (at which the Brix should be 34 ± 3°) the measured values were three times greater than at 20°C.

* * *

Granulometry and determination of granulometric control of auxiliary filtration materials. R. OSVALD and E. HAVLOVÁ. *Ind. Alim. Agric.*, 1972, **89**, 1043–1047.—Details are given of a test, using the OSTWALD-KELLY-HAHN apparatus, for determining particle size distribution of filter aids and juice dispersion systems, based on measurement of settling time. Experimental results are given for "Hyflo-Super-Cel". The mean error of the method does not exceed 7%.

* * *

Comparative tests on the blue number method. M. BURBA and E. LURZ. *Zeitsch. Zuckerind.*, 1972, **97**, 566–576.—Determination of α-amino-N in beet by the so-called "blue number" method and its modifications was investigated and of the various procedures tested that of CAROLAN[1] found to be best for routine purposes.

* * *

Certain properties of sugars and their aqueous solutions. R. S. BURDUKOVA *et al. Izv. Vuzov, Pishch. Tekh.*, 1972, (3), 37–45.—Experimental data for sucrose, glucose and fructose are compared for infra-red light absorption and light scattering, molecular auto-diffusion in aqueous solutions of certain carbohydrates, refractive indices, viscosity, and ultrasonic wave spread. Conclusions are drawn on the nature of molecular interaction and recommendations given on choice of radiation equipment for optimum drying of the sugars.

* * *

Use of gel chromatography for investigation of interaction between sucrose and salts. N. P. SILINA, K. ČÍŽ, L. M. YANGOL' and L. P. MIRONOVA. *Izv. Vuzov, Pishch. Tekh.*, 1972, (3), 178–180.—Column chromatography on "Sephadex G-25" showed that sucrose forms a binary compound with NaCl and KOH but not with KCl and K acetate, so that the marked effect of K and Na on sucrose solubility cannot be attributed solely to the formation of compounds with sucrose.

* * *

Investigation of sucrose crystallization in the presence of $CaCl_2$ and KNO_3. S. E. KHARIN, V. F. DOBROMIROVA and V. M. KHARIN. *Sakhar. Prom.*, 1972, (9), 21–23.—Laboratory studies are reported in which $CaCl_2$ and KNO_3 were each found to cause a reduction in the nucleation and crystal growth rates of sucrose in supersaturated aqueous solutions. Under otherwise equal conditions, $CaCl_2$ had a greater effect than did KNO_3 and gave a final crystal quantity which was smaller than with KNO_3, while the sucrose crystals formed in the presence of $CaCl_2$ were larger.

* * *

Rôle of iron ions in colorant formation in sugar production. I. F. BUGAENKO and M. MUKHAMED. *Sakhar. Prom.*, 1972, (9), 33–36.—Laboratory studies showed that ions of iron liberated by corrosion processes were included in colorant molecules and formed coloured complexes, thus increasing the colour content resulting from invert destruction and melanoidin formation.

* * *

Chromatographic determination of non-volatile, non-nitrogenous organic acids in factory sugar solutions. F. SCHNEIDER, A. EMMERICH, C. REICHEL and A. WEDLER. *Zucker*, 1972, **25**, 679–687.—Details are given of organic acids determination by thin-layer chromatography on cellulose after separation of the acids from the factory product (beet juice, run-off or molasses) on "Amberlite IR-120" cation exchange resin in H^+ form and "Amberlite IRA-400" anion exchanger in acetate form, eluting with formic acid. Oxalic, sulphuric and hydrochloric acids are not eluted and so cannot interfere in the chromatographic analysis. The use of three ester-containing solvents

[1] *I.S.J.*, 1959, **61**, 44–45.

permits quantitative determination of 18 acids by comparison with standard solutions. Accuracy is to within ± 5–10% at an acid: juice ratio of up to 1:80, permitting the method to be used satisfactorily for routine purposes.

* * *

Instrument for determining standard molasses purity by a rapid method. M. I. PERERVIN, I. A. PRIKHOD'KO, E. A. KOVAL'CHUK and V. A. PONOMARENKO. *Sakhar. Prom.*, 1972, (9), 49–50.—For determining standard molasses purity using previously published formulae, a device has been developed which permits molasses saturation to take place during rotation and vibration of the sample held for a required time at constant temperature.

* * *

Determination of seed quality. V. VALTER and J. HORNÍKOVÁ. *Listy Cukr.*, 1972, **88**, 228–235.—Methods of determining seed slurry granulometry and concentration of the suspension are examined. For the former, the best method is considered to be plotting of a distribution frequency curve from photomicrographs and converting to mass frequency; particle content is best found by using a Thom cell, giving an accuracy to within ± 6%.

* * *

Judgement of white sugar quality: use of photoelectric reflectance measurements for reproduction of Indian sugar standards and for uniform gradation. S. K. D. AGARWAL and R. C. GUPTA. *Proc. 4th Joint Conv. Indian Sugar Tech. Assocs.*, 1971, G.63–G.71.—Advantages of using white sugar reflectance measurements are discussed on the basis of experiments, which showed considerable variation in colour of the standards with grain size as well as marked deterioration over the years. The possibility of introducing 31 colour standards was demonstrated.

* * *

Determination of sucrose in sugar beet by the isotope dilution method. H. GRUSZECKA. *Gaz. Cukr.*, 1972, **80**, 139–140.—Comparison between polarimetric determination and the isotope dilution method gave an average difference of 1·13% sucrose for 20 beet samples, polarization giving a higher value in all cases.

* * *

Adaptation of gas chromatography to carbohydrate determination. H. GRUSZECKA and S. KUBACKI. *Gaz. Cukr.*, 1972, **80**, 140–141.—Determination of sugars by gas chromatography using a Pye-Unicam Series 104 chromatograph after trimethylsilylation using a 10:2:1 mixture of pyridine:hexamethyldisilazane:trimethylchlorosilane is briefly reported.

* * *

Determination of carbohydrates in sugar factory juices. H. GRUSZECKA. *Gaz. Cukr.*, 1972, **80**, 141–142.—Gas chromatography revealed only occasional small quantities of raffinose apart from sucrose in press juice samples from healthy beet, while deteriorated beet juice was found to contain sucrose, glucose, fructose, galactose, raffinose, an unidentified disaccharide (probably palatinose) and an unidentified trisaccharide (probably kestose). Analysis of juice from beet which had been frozen and then thawed (7 days) revealed no carbohydrate at all.

* * *

Rapid reductometric determination of invertose in sucrose-invertose mixtures. E. KRAUSE, L. SCHMIDT and F. TÖDT. *Zeitsch. Zuckerind.*, 1972, **97**, 367–376. Details are given of the procedure and apparatus used to determine invert sugar in sucrose-invert mixtures on the basis of measurement of the amount of periodic acid used to oxidize the invert[1,2,3]. Application of the method in the sugar and starch industries is discussed and its accuracy and reproducibility indicated.

* * *

Use of aluminium salts to determine beet sugar content by polarization. A. A. LIPETS and I. A. OLEINIK. *Sakhar. Prom.*, 1972, (7), 47–48.—Tests on the use of aluminium sulphate or chloride as clarifying agent for sugar determination by polarization indicated that the aluminium compound had no effect on the polarimeter reading while ensuring an absolutely clear solution. Analytical error was within the experimental limits. Both aluminium compounds gave values in close agreement with those obtained with lead acetate.

* * *

Comparative study on the use of the system of absolute juice and that of normal juice in the chemical control of sugar factories. H. LÓPEZ V. *Bol. Azuc. Mex.*, 1962, (266), 9–11.—It is argued that the use of absolute juice as the basis for chemical control is unsound and that the normal juice system is preferable.

* * *

Dependence of interdiffusion coefficients on concentration and temperature in the system sucrose-water and in beet sugar factory syrups. L. P. ZHMYRYA, M. N. DADENKOVA and V. M. LYSYANSKII. *Izv. Vuzov, Pishch. Tekh.*, 1972, (2), 125–128.—Continuing investigations of molecular diffusion[4], the authors have found that at concentrations of 40% sucrose and above, the diffusion-concentration relationship can be expressed by an exponential equation while below 40% concentration there is deviation which decreases with temperature rise. Reasons for the behaviour are given. Linearity in the concentration-diffusion relationship for factory syrups was established for the concentration range 40–70%. In this range and at temperatures of 25–90°C the diffusion coefficient was 20–30% smaller than for pure sucrose solution as a result of the effect of impurities.

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[1] TÖDT: *I.S.J.*, 1967, **69**, 282.
[2] TÖDT *et al.*: *ibid.*, 1971, **73**, 91.
[3] *idem ibid.*, **248**.
[4] ZHMYRYA *et al.*: *I.S.J.*, 1970, **72**, 250; 1973, **75**, 223.

Patents

UNITED STATES

Processing sugar cane. S. E. TILBY, of Winterburn, Alta., Canada, *assr.* CANADIAN CANE EQUIPMENT LTD. **3,690,358.** 4th January 1971; 12th September 1972. See UK Patent 1,225,849[1].

* * *

Simultaneous determination of glucose and fructose. K. LAUER, H. SPINGLER, K. E. WALLACH and G. STOECK, *assrs.* C. F. BOEHRINGER & SOEHNE G.M.B.H., of Mannheim-Waldhof, Germany. **3,694,158.** 20th February 1970; 26th September 1972.—The optical rotation and refractive index of an aqueous solution of glucose and fructose of 50–70°C (the effluent from an ion exchanger column for separation of the two from an invert sugar solution) are measured by means of a continuously registering polarimeter and refractograph and the measurements related to the concentrations of the two hexoses. The evaluation is by means of a nomogram based on a series of calibration values obtained using measurements of known samples and may also be obtained in the form of proportional signals (voltages) which are fed to a data processing system adapted to control the manufacture of glucose and fructose.

* * *

Sanitation of sugar factories. J. A. CASEY, of Pepper Pike, Ohio, USA. **3,694,262.** 31st July 1969; 26th September 1972.—Loss of sucrose in sugar juice is reduced and the sanitary condition of sugar extracting plant improved by adding to the sugar-bearing raw material (beet or cane) (an average of) 0·5–10 p.p.m. on juice weight [by shock addition for 1–10 (5) minutes every ½–2 (½) hour] of a bactericidal cationic quaternary ammonium composition (in 10% aqueous solution) containing 25% n-alkyl dimethyl benzyl ammonium chloride and 25% n-alkyl dimethyl ethyl benzyl ammonium chloride) (with 50% inert ingredients) in not more than the first half of the extraction equipment (and spraying at least once every 24 hours areas surrounding this equipment).

* * *

Bagasse fibre product and process. R. BOTZ, of San Juan, Puerto Rico, *assr.* PLASTIFIBER FORMULATIONS INC. **3,694,308.** 9th October 1969; 26th September 1972.—Raw bagasse is treated with an aqueous alum solution and subjected to simultaneous or preliminary (mechanical) defibration. The fibre is separated and dried and the dry fibre classified, yielding a fraction of average length ¼–4 inches. The fraction of smaller than ¼ inch fibre length is converted to a flour while the fraction of greater than 4 inches fibre length is cut to reduce its average length and recycled.

* * *

Phosphorus-containing sugar polyols and polyurethane foams therefrom. J. S. HECKLES and E. J. QUINN, of Lancaster, Pa., USA, *assrs.* ARMSTRONG CORK CO. **3,694,430.** 5th May 1969; 26th September 1972.—One mole of an oxyalkylated sugar and 1–6 moles of a phosphono-substituted carboxylic acid ester are heated together to give an ester-interchange reaction product which can be reacted conventionally with polyisocyanates to form self-extinguishing or flame-retardant polyurethane foams having good stability against hydrolysis.

* * *

Beet harvester. R. W. HOOK and R. D. ZAUN, of Des Moines, Iowa, USA, *assrs.* DEERE & CO. INC. **3,695,360.** 17th December 1971; 3rd October 1972.

* * *

Wet bagasse milling extraction process. T. M. HAMILL, of Kailua, Hawaii, USA. **3,695,931.** 31st March 1970; 3rd October 1972.—Bagasse is subjected to a series of (3–7) macerations with a (cold) imbibition liquid and high-pressure (2000–5000 p.s.i.) extractions in a tandem (of 3-roller units) in which part of the liquid content is expressed and liquid-bearing cells are ruptured. Before each high-pressure extraction the bagasse is subjected to maceration with [5–35% (15–25%) of] (hot) imbibition liquid [to give a juice: fibre ratio of > 4·5:1 (4·5–13:1)] (in a unit of at least 2 rollers) and to a low-pressure [50–800 (300–500) p.s.i.] extraction which expresses liquid but does not cause substantial cell rupture. The expressed liquid in each case is returned as imbibition liquid for the immediately preceding extraction (at the same pressure), juice from the first (the first two) being sent to process. At least 2 (2–5) of the 2–8 low-pressure extractions may be carried out in immediate tandem before the high-pressure extractions. Fresh imbibition liquid (water) may be added to at least 2 extractions in the tandem (one high-pressure and one low-pressure).

[1] *I.S.J.*, 1972, **74**, 123.

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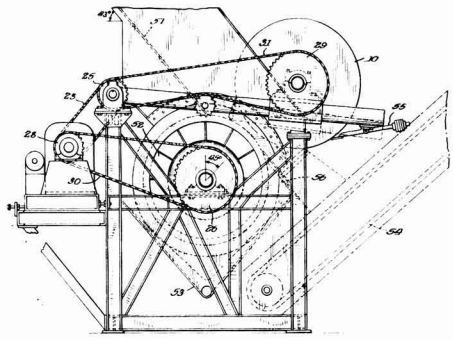
Sucrose nucleation composition. A. D. RANDOLPH and R. W. CRAWFORD, of Tucson, Ariz., USA, *assrs.* THE BATTELLE DEVELOPMENT CORPORATION. **3,695,932.** 29th July 1970; 3rd October 1972.—Sufficient of a low M.W. polar organic compound which is a C_1–C_8 aliphatic ether, ester, ketone, alkanol or a mixture of these [a C_1–C_6 alkanol (ethanol)] is added to a (invert-free) sucrose feed syrup comprising 60–80% sucrose and 20–40% water to give an organic compound: water ratio of 0·6:1–3:1 [1:1–2:1 (1·2:1–1·6:1)], mixing these and so producing single-crystal nuclei of average size 10–30μ in a concentration of 100,000 nuclei per cm^3 which may be used as seed for sugar boiling to give regular grain.

* * *

Bagasse water removal. C. R. STEELE, F. B. PRICE and J. M. MARSHALL, of Denver, Colo., USA, *assrs.* CF & I ENGINEERS INC. **3,697,324.** 2nd October 1969; 10th October 1972.

The water content of bagasse from a diffuser is reduced from about 85% to about 70% to give a less wet feed to a press or similar equipment which can then give a final bagasse of less than 50% water content. The initial reduction is achieved at low pressure by passage of the wet bagasse along a conveyor chute 51 which is at an angle of 42–45° to the horizontal (giving the desired flow rate) and between a perforated lower roller and an upper imperforate roller 10, the latter being weighted to give the requisite pressure.



A flange on the outer edges of the lower roller overlaps the edges of the upper roller and the latter is mounted on an axle with bearings fastened to pivoting arms so that the upper roller follows the level of bagasse on the chute. Both rollers are driven by chains from motor 28 and water draining through the perforations in the lower roller collect in chamber 53 from which it is removed.

* * *

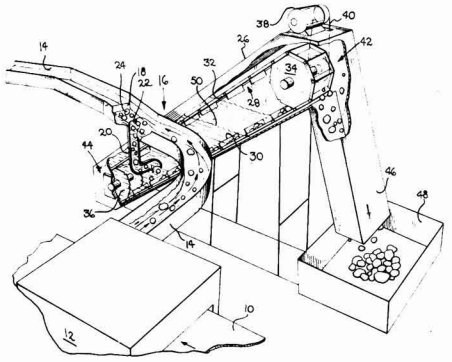
Preparing cane stalks for subsequent processing. S. E. TILBY, of Winterburn, Alta., Canada, *assr.* CANADIAN CANE EQUIPMENT LTD. **3,698,459.** 2nd September 1970; 17th October 1972.—See UK Patent 1,226,254[1].

Dry cane or beet molasses. A. P. PELLEGRINI, of Belo Horizonte, Brazil. **3,698,911.** 9th December 1970; 17th October 1972.—Liquid molasses at 60–70°C is adjusted to pH 8–10·5 (8·5–10·5) [by adding (150-mesh) $Ca(OH)_2$] and dried (by spray drying). The dried product is then neutralized to pH 6·8–7·2 by addition of an acidic agent ($CaHPO_4$ or H_3PO_4).

* * *

Removing rock from unscreened cane juice. K. E. STEPPE and A. L. WEBRE, *assrs.* OWENS-ILLINOIS INC. **3,698,949.** 27th November 1970; 17th October 1972.

Mixed juice containing rocks 24 and bagacillo is conducted along trough 14 from the mill, designated as 12. Across the bottom of the trough is a low dam 18 while a vertical rock removal trap 20 is located before it so that rocks are prevented from continuing beyond the dam and fall down the trap to the closed housing 26 of drag conveyor 28. Here the rocks are



raised by the conveyor out of the liquid and are discharged into chute 46 leading to container 48. A counterflow of juice is provided so that juice flows from the upper end of housing 26 to the lower and back up trap 20, so preventing the bagacillo falling through the last; it is removed by screening after it has passed down trough 14 past the dam 18.

* * *

Sugar refining. M. C. BENNETT, of London, England, *assr.* TATE & LYLE LTD. **3,698,951.** 17th July 1970; 17th October 1972.—Melter liquor is purified by addition of (0·005–0·5% of) a cationic surfactant [one or more of a group comprising long hydrocarbon chain quaternary ammonium compounds (dialkyl dimethyl quaternary ammonium compounds in which at least one alkyl group has 8 C atoms, dihexadecyl dimethyl quaternary ammonium compounds, dioctadecyl dimethyl ammonium compounds), long hydrocarbon chain tertiary amines and long hydrocarbon chain pyridinium compounds] so forming an insoluble complex with high M.W. anionic impurities present in the liquor. An inorganic precipitate ($CaCO_3$ or Ca phosphate) may be formed in the liquor and the precipitate removed (by flotation).

[1] *I.S.J.*, 1972, **74**, 123–124.

Brazil sugar exports, 1972[1]

	1972	1971	1970
	(*metric tons, raw value*)		
Algeria	77,859	40,180	0
Bangla Desh	35,955	0	0
Bolivia	42,400	0	0
Canada	0	0	9,550
Chile	26,098	7,738	0
China	410,609	0	0
Dutch Guiana	1,064	0	0
Egypt	49,022	0	0
Finland	47,759	39,600	0
France	48,441	34,915	57,188
Germany, East	46,853	0	0
Germany, West	0	14,385	0
Ghana	0	0	25,321
Iran	11,550	0	0
Iraq	49,508	47,254	0
Japan	112,283	12,000	158,934
Jordan	13,412	0	0
Korea, South	0	0	20,000
Lebanon	11,000	0	4,988
Malaysia	0	38,283	0
Morocco	55,404	69,115	10,115
Pakistan	178,916	0	0
Paraguay	25	0	0
Poland	12,600	0	0
Portugal	9,971	0	0
Rumania	0	44,407	0
Senegal	14,450	25,171	12,150
Singapore	31,852	11,400	0
Somalia	8,480	0	0
Spain	0	0	16,315
Sri Lanka	80,553	10,653	0
Sudan	26,768	0	0
Syria	32,825	25,000	0
Tunisia	62,736	45,200	26,046
UK	18,847	0	0
Uruguay	42,000	14,886	48,590
USA	621,241	597,684	607,036
USSR	325,289	0	0
Vietnam, South	94,327	152,506	133,615
Yugoslavia	34,075	0	0
Zaire	3,353	0	0
	2,637,525	1,230,377	1,129,848

US cane sugar production 1972/73[2].—The 1972/73 US mainland sugar crop closed with final production amounting to 1,620,275 short tons, raw value, of which the Florida contribution was a record 960,562 tons. Current estimates of the 1973/74 crop stand at 1·65 million tons. The US Department of Agriculture has announced that there will be no restriction (for the first time since 1964) on the 1974 cane crop, and it is hoped thereby to raise production and bring about a more healthy carry-over stock situation by the beginning of 1975.

* * *

Lebanon sugar imports, 1972[3].—Imports of sugar into Lebanon in 1972 totalled 53,727 metric tons, tel quel, of which 53,414 tons were raw sugar and the balance refined. The principal suppliers were Cuba (34,679 tons), Mozambique (10,152 tons) and Brazil (6319 tons). Imports in 1971 were 54,589 tons and had included 28,825 tons supplied by the USSR.

* * *

New Egyptian sugar factory[4].—Erection of a new sugar factory with an annual capacity of 50,000 tons has been approved in Egypt.

* * *

Argentina sugar expansion[5].—A substantial expansion of sugar production is expected in Argentina this year. The area is reported to have risen from the 1972 record of 255,600 hectares to 318,700 hectares while, according to the first estimate of the Ministry of Agriculture, 14·7 million tons of cane will be harvested, compared with 12·87 million tons in 1972. Sugar production in 1972 amounted to 1,209,849 metric tons, tel quel.

South Africa sugar exports[6]

	1972	1971	1970
	(*metric tons, raw value*)		
Canada	272,384	262,293	212,794
Finland	73,198	0	0
Hong Kong	6,033	15,356	0
Israel	55,435	10,870	0
Japan	568,625	372,372	269,585
Seychelles	2,210	2,022	2,131
Sri Lanka	13,077	0	0
UK	19,363	0	33,937
USA	28,576	81,949	71,906
Vietnam, South	0	10,604	0
Other countries	7,040	10,532	449
Total	1,045,941	765,998	690,802

Errata.—Line 14 of the text in column 1 of page 237 of our August issue should read "formation, the ballooning of tins;" and line 6 in column 2 of page 238 should read "type cultures of *Clostridium thermosaccharolyticum*".

* * *

US beet sugar factory closure[7].—In February, American Crystal Sugar Co. was merged with Crystal Growers' Corporation, an affiliate of the Red River Valley Sugarbeet Growers' Association. The American Crystal factory at Mason City, Iowa, was immediately closed down for a variety of reasons including anticipated loss of acreage to the projected new factory at Renville, Minnesota.

* * *

Sweden sugar imports and exports[8].—In 1972 Sweden imported a total of 121,501 metric tons, raw value, a reduction from the 154,647 tons imported in 1971. Major suppliers were Cuba (63,086 tons), Finland (36,140 tons), the USSR (15,366 tons) and Poland (5219 tons). During the year exports amounted to 9242 tons, as against 13,056 tons in 1971; almost all went to Algeria (3804 tons), Norway (2095 tons) and the UK (2336 tons).

* * *

French sugar companies merger.—The shareholders of Société des Raffineries et Sucreries Say S.A. and of F. Béghin S.A. agreed at the end of June to the merger announced earlier[9]. A new company has been formed, with the title Béghin-Say S.A., and will control 14 sugar factories with a total slice of 60,000 tons/day. The new company will be the largest in France and the second largest in Europe, after the British Sugar Corporation Ltd. A new development programme has been drawn up[10]: A new sugar factory of 6000 tons/day capacity is to be built at Connantre in the Marne Department, while the capacity of the Corbehem factory is to be raised from 5650 to 12,000 tons/day by the 1974/75 campaign.

* * *

Mauritania sugar refinery project[11].—The Minister for Planning and Development has signed a contract with the Lang Engineering Corporation for the construction of a sugar refinery in Nouakchott. The project provides for investments amounting to 2250 million CFA francs, to be provided exclusively by the Government of Mauritania. The new refinery, which is to be completed within 28 months, is to have a capacity of 30,000–40,000 tons per year and will initially process imported raw sugar, later working with raw sugar produced locally.

[1] F. O. Licht, *International Sugar Rpt.*, 1973, **105**, (16), xi.
[2] C. Czarnikow Ltd., *Sugar Review*, 1973, (1136), 128.
[3] *I.S.O. Stat. Bull.*, 1972, **32**, (5), 65.
[4] F. O. Licht, *International Sugar Rpt.*, 1973, **105**, (21), 9.
[5] C. Czarnikow Ltd., *Sugar Review*, 1973, (1135), 125.
[6] *I.S.O. Stat Bull.*, 1973, **32**, (5), 94.
[7] *Sugar J.*, 1973, **35**, (12), 14.
[8] *I.S.O. Stat. Bull.*, 1973, **32**, (5), 99–100.
[9] *I.S.J.*, 1972, **74**, 322.
[10] *Zeitsch. Zuckerind.*, 1973, **98**, 469.
[11] F. O. Licht, *International Sugar Rpt.*, 1973, **105**, (18), 9–10.

East Africa sugar statistics[1]

	1972				1971
	Kenya	*Tanzania**	*Uganda*	*Total E. Africa*	*E. Africa*
	(*metric tons, tel quel*)				
Initial stocks..	12,882	7,420	2,544	22,846	26,010
Production ..	92,284	88,483	121,439	302,206	360,891
Imports	113,617	46,885	0	165,502	88,286
	218,783	142,788	123,983	485,554	475,187
Consumption	194,612	133,370	123,290	451,272	452,341†
Final stocks ..	24,171	9,418	693	34,282	22,846

* Excluding Zanzibar and Pemba
† Includes 8 tons exported outside East Africa.

Jordan sugar imports 1972[2].—Imports of refined sugar by Jordan increased from 46,732 metric tons in 1971 to 65,405 tons in 1972. Principal suppliers included South Africa (19,998 tons), Brazil (12,600 tons), Poland (10,500 tons), the USSR (7359 tons) and France (6091 tons).

* * *

US cane sugar factory closures[3].—The Delgado-Albania sugar factory in Louisiana was recently closed and it has also been decided to close the Angola mill operated at Louisiana State Penitentiary. A new cooperative, Jeanerette Sugar Company, has been formed to take over the former Duhe-Bourgeois factory; it will crush part of the cane of farmers who formerly supplied the Albania mill.

* * *

Fiji sugar exports[4].—Exports of sugar from Fiji in 1972 totalled 290,293 metric tons, raw value, as against 354,194 tons in 1971. Destinations were the UK (156,185 tons), USA (42,438 tons), Canada (33,841 tons), New Zealand (27,419 tons), Japan (17,990 tons) and Finland (12,420 tons).

* * *

New Brazilian sugar factory[5].—The Instituto do Açucar e do Alcool recently signed a contract for financing erection of the Seresta mill at São Miguel dos Campos, some 42 miles from the capital of Maceió in Sergipe. It is to be the newest industrial sugar unit of its type and should begin operations before the end of the year. The investment in the mill, which will produce approximately 150,000 bags of sugar (9000 metric tons) in the 1973/74 harvest, will be some US $5,000,000 and the capacity of the project can be raised to 800,000 bags (48,000 tons). Some $17,000,000 is being invested by other Sergipe mills to modernize equipment and expand production.

* * *

Swaziland sugar exports[6].—Sugar exports from Swaziland totalled 189,378 metric tons, raw value, in 1972 as against 159,271 tons in 1971. Destinations included Canada (49,096 tons), Malawi (474 tons), the UK (92,548 tons), USA (29,376 tons) and Zambia (17,884 tons).

* * *

Yugoslavia sugar imports[7].—Imports of sugar by Yugoslavia increased from 155,431 metric tons, tel quel, in 1971 to 271,286 tons in 1972. Over half was supplied by France (151,764 tons), while Rumania supplied 56,822 tons, Cuba 27,423 tons, Czechoslovakia 11,424 tons and Turkey 9490 tons.

* * *

Mauritius Government acquisition of sugar factory[8].—The Mauritius Government has decided to purchase the sugar estate and factory at Rose Belle, at a cost of some 19 million rupees. The estate comprises over 2500 arpents of cane and the factory also processes cane from 2000 arpents of surrounding cane fields owned by over 1000 small planters. The estate will provide valuable information to the Government regarding the cost of production of sugar on the island as it is the first time that the State has ever taken direct participation in the sugar industry—the largest single revenue earner of the country.

Dominican Republic sugar statistics[9]

	1971		1972	
	(*metric tons, raw value*)			
Initial stocks.....		224,349		209,363
Production		1,132,491		1,173,208
		1,356,840		1,382,571
Consumption		136,285		145,669
Exports				
Algeria	0		12,769	
Canada	10,988		10,996	
Finland	13,087		4,995	
France	23,450		25,383	
Germany, East..	0		37,832	
Iraq	12,864		0	
Japan	174,463		193,196	
Malaysia	27,075		27,060	
Morocco	0		8,875	
New Zealand ..	52,697		26,356	
Senegal	1,892		0	
Singapore	29,635		0	
Sri Lanka	0		12,978	
Surinam	0		444	
Tunisia	0		13,187	
UK	0		31,230	
USA	665,041		692,612	
USSR	0		23,846	
Vietnam, South	0		19,569	
		1,011,192		1,141,328
Final stocks		209,363		95,574

Jamaican cane by-products animal fodder plant[10].—Jamaica Cattle Feed Ltd., a new company, has been set up with a pilot plant which is producing 5 tons per day of "Pimola", a cattle feed using bagasse pith as the main ingredient, with molasses, urea and vitamins A and D. The new feed has been tested at the University of the West Indies and found to compare favourably with such feed supplements as citrus pulp, yellow corn, etc.

* * *

Bagasse utilization in Puerto Rico[11].—A construction company is planning to establish a factory for the manufacture of decorative board, using as raw material bagasse supplied by Central Cambalache. The new plant will use the facilities left by International Paper Co. which is closing its operations in the manufacture of cartons using bagasse and waste paper. Another enterprise is being established on the site of Central Los Caños which was closed by the Government because of a shortage of cane supply. Several years ago it was decided to close the Government-owned Central Plazuela at Barceloneta, at that time operated by the Land Authority. There was not enough cane supply in the area to justify operation of the mill but its closing would have meant an increase in unemployment; finally the mill was closed and a tissue paper factory established on the site which, in the event, generated more employment than had the sugar factory.

* * *

Cuban aid for Sierra Leone[12].—The Cuban Government has declared its willingness to help Sierra Leone develop a sugar industry.

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[1] C. Czarnikow Ltd., *Sugar Review*, 1973, (1132), 110.
[2] *I.S.O. Stat. Bull.*, 1973, **32**, (5), 62.
[3] *Sugar Bull.*, 1973, **51**, (17), 4.
[4] *I.S.O. Stat. Bull.*, 1973, **32**, (5), 42.
[5] *Sugar y Azúcar*, 1973, **68**, (5), 50, 52.
[6] *I.S.O. Stat. Bull.*, 1973, **32**, (5), 98.
[7] F. O. Licht, *International Sugar Rpt.*, 1973, **105**, (21), v.
[8] *Barclays International Review*, June 1973, 16.
[9] *I.S.O. Stat. Bull.*, 1973, **32**, (6), 36.
[10] *Trinidad Guardian*, 21st March 1973; through *The Cane Farmer* (Trinidad), 1973, **14**, 63.
[11] *Sugar y Azúcar*, 1973, **68**, (4), 36.
[12] *Barclays International Review*, June 1973, 22.

Brevities

New Canadian liquid sugar plant.—A new building for the production, storage and shipment of liquid sugars has just been completed in Chatham, Ontario, by Redpath Sugars Ltd. The plant includes two silos holding 2000 short tons of granulated sugar, and a fully-automatic truck weighing station.

* * *

Indonesian sugar imports[1].—According to a spokesman of the Indonesian National Supply Office, imports of sugar totalled 116,606 tons, tel quel, during 1972. In 1973 sugar production is expected to increase to 945,000 tons, compared with 909,000 tons in 1972.

* * *

Panama sugar factory[2].—The Government-sponsored Central Victoria sugar factory in Veraguas has been opened; it will produce 5000 tons of sugar but will have a normal annual production capacity of 40,000 tons[3].

* * *

Portuguese East Africa sugar production[4].—Output of sugar in Angola in 1972 totalled 105,605 tons, worth 363·4 million escudos, compared with 106,823 tons, worth 327·3 million escudos, in 1971.

* * *

Czechoslovakia sugar exports, 1972[5].—Exports of sugar from Czechoslovakia fell from 320,493 metric tons, raw value, in 1971 to 228,545 tons in 1972. Principal destinations were Saudi Arabia (85,062 tons), the UK (27,597 tons), USSR (21,766 tons), Norway (13,805 tons), Yugoslavia (12,500 tons) and Yemen (11,636 tons).

* * *

Canada beet sugar crop, 1972/73[6].—The beet area in Canada (Alberta, Manitoba and Quebec) amounted to 77,587 acres for the 1972/73 crop as against 81,096 acres the previous crop. Sugar production was similarly reduced from 134,680 long tons to 113,037 tons during the 1972/73 campaign.

* * *

New Indian sugar factory[7].—A new sugar factory, Vidarbha Cooperative Sugar Factory, has gone into operation at Pophali, near Pusad in Yeotmal district of Maharashtra. A second cooperative sugar factory is under erection in Buldhana district.

* * *

Sierra Leone sugar industry investigation[8].—A survey team has arrived in Sierra Leone from China to look into the possibilities of establishing a 3000-acre sugar cane plantation and a sugar factory.

* * *

Yeast plant in India[9].—A plant for the production of compressed bakers' yeast at the rate of half a ton per day has been set up at Dhampur Sugar Factory using indigenous equipment and technical assistance from the National Sugar Institute.

* * *

Iraq sugar expansion study[10]—Studies are being undertaken on the establishment of sugar factories in most of the Iraqi provinces as part of the country's next five-year plan, according to the Head of the Chemical and Food Department. The aim of the project is to meet the country's growing need for sugar and increase dependence on local sources. Iraq produces 242,000 tons of sugar a year; this will rise to 300,000 tons next year, once a plant at Suleimaniya, in the north, goes into production. During the next five years, a wider area will be planted with sugar cane and beet and the varieties grown will be improved.

* * *

Honduras sugar imports[11].—Normally Honduras is an exporter of about 10,000 tons a year, almost all of which is shipped to the USA. This year it has been necessary to import, however, and it was announced at the end of August that 10,000 tons of Cuban sugar had been acquired for prompt delivery.

Thailand sugar exports[12]

	1971	1972*
	(metric tons, tel quel)	
Destinations		
France	0	13,440
Hong Kong	0	15,985
Japan	44,810	34,961
Jordan	0	21,598
Malaysia	5,010	74,292
Nepal	0	6,466
Pakistan	0	45,336
Saudi Arabia	0	21,831
Singapore	17,790	2,194
Sri Lanka	0	76,532
Sudan	0	30,242
USA	16,572	16,806
Vietnam, South	60,828	68,918
Yugoslavia	0	10,260
Total	145,010	438,861

* Raw value.

Bagasse furfural plant in the Philippines[13].—About $2,200,000 is being invested by a member of the World Bank Group in Victorias Chemical Co., a newly-formed subsidiary of the Victorias Milling Co. of the Philippines, which will be the first producer of furfural in south-east Asia. It will utilize a new process developed in Finland and will produce 5000 tons of furfural per year, using bagasse as raw material. Process equipment will be supplied by Oy. W. Rosenlew of Pori, Finland, while auxiliary equipment will be built locally. More than 80% of production is to be exported to Japan and other south-east Asian markets while the remainder will be used in the Philippines.

* * *

Chile sugar statistics[14].—While consumption in Chile has grown from 329,000 metric tons, raw value, in 1970 to 388,000 tons in 1971 and 402,000 tons in 1972, production has fallen during the same years from 228,000 tons to 192,000 tons to 152,000 tons. As a consequence, imports rose from 56,000 tons in 1970 to 152,000 tons in 1971 and 230,000 tons in 1972. Nevertheless, stocks have fallen from 108,000 tons at the end of 1970 to 64,000 tons at end-1971 and 44,000 tons at end-1972.

* * *

Bolivia furfural manufacture[15].—A European consortium led by Petrole-Chimie of France is to build two plants to produce furfural, furfurylic alcohol and furanic resins from bagasse. The cost of the project is equivalent to 20,000,000 U.S. dollars and the plants, to be built in Santa Cruz and Bermejo, should be in operation by 1976.

* * *

Argentina sugar exports, 1972[16].—Exports of sugar from Argentina totalled 167,134 metric tons, raw value, in 1972 as against 121,138 tons in 1971. As usual, the principal destination was the USA (77,830 tons) while others included Sri Lanka (26,167 tons), Morocco (23,221 tons), the USSR (16,015 tons), South Vietnam (9675 tons), Portugal (9619 tons), and Ireland (4607 tons).

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[1] F. O. Licht, *International Sugar Rpt.*, 1973, **105,** (18), 10.
[2] *Bolsa Review*, 1973, **7,** 344.
[3] *I.S.J.*, 1971, **73,** 384.
[4] *Bolsa Review*, 1973, **7,** 360.
[5] *I.S.O. Stat. Bull.*, 1973, **32,** (5), 34.
[6] C. Czarnikow Ltd., *Sugar Review*, 1973, (1131), 104.
[7] *N.S.I. News* (India), 1973, **8,** (4), 4–5.
[8] *Barclays Int. Review*, July 1973, 22.
[9] *N.S.I. News* (India), 1973, **8,** (4), 6.
[10] *Reuters Sugar Rpt.*, 19th June 1973.
[11] C. Czarnikow Ltd., *Sugar Review*, 1973, (1142), 151.
[12] *I.S.O. Stat. Bull.*, 1973, **32,** (6), 103.
[13] *Sucr. Belge*, 1973, **92,** 324.
[14] *I.S.O. Stat. Bull.*, 1973, **32,** (6), 26.
[15] *Bolsa Review*, 1973, **7,** 383.
[16] *I.S.O. Stat. Bull.*, 1973, **32,** (6), 17.

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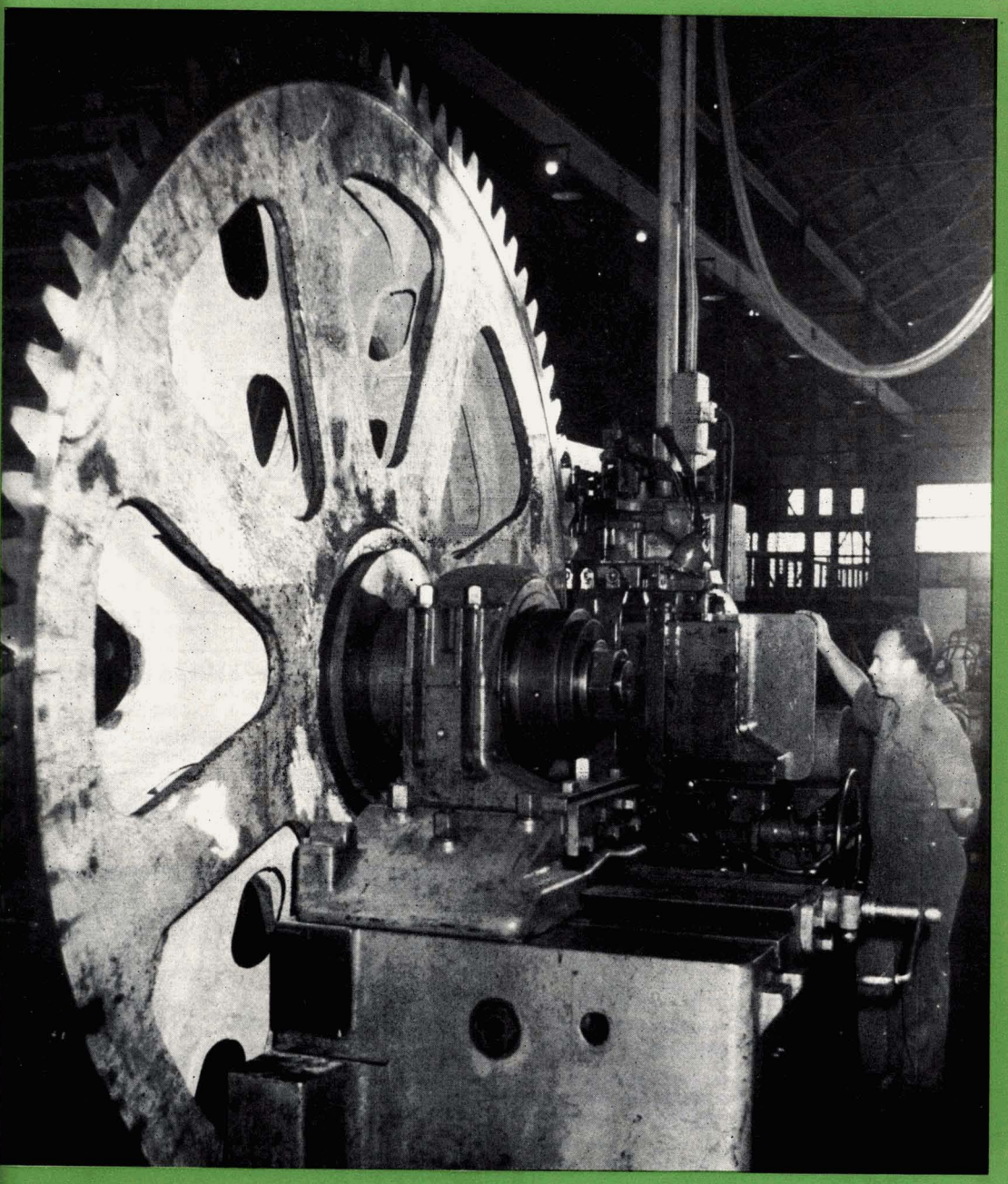

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