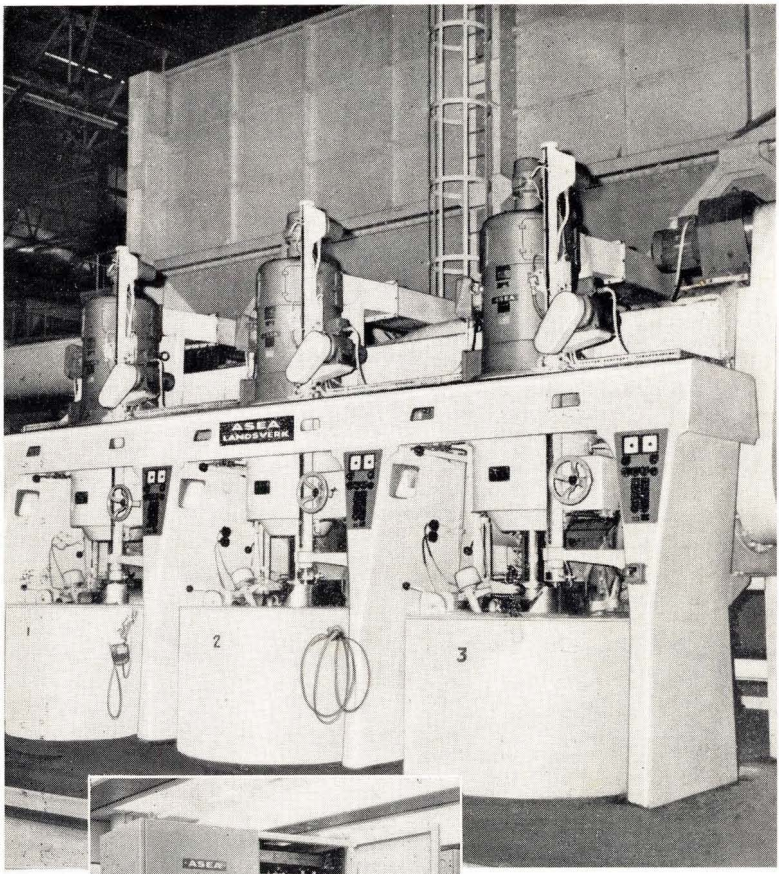
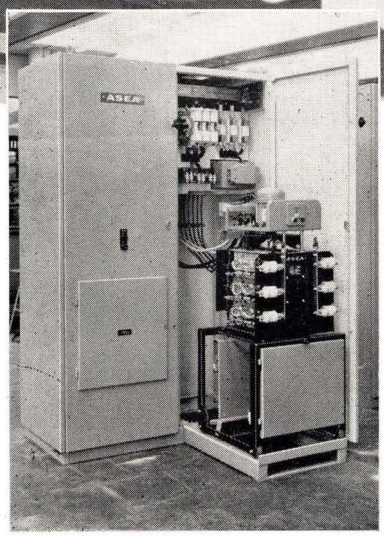
International Sugar Journal

VOL. 67 *July 1965* No. 799

Published by
The International Sugar Journal Ltd.
Central Chambers, The Broadway,
London, W.5.
Telephone: EALing 1535
Cable: Sugaphilos, London, W.5.

Annual Subscription: 32s 0d or $5.00 post free
Single Copies: 2s 6d or 45 cents plus postage





Cubicle with built-in static converter and control equipment.

ASEA-Landsverk centrifugals now supplied to

Argentine
Australia
Belgium
Denmark
Finland
France
Great Britain
Iran
Ireland
Italy
Mauritius
Mexico
Republic of the Congo
South Africa
Spain
Sweden

ASEA-Landsverk

fully-automatic centrifugals

D.C. motor drive with static controlled silicon rectifiers

ASEA

VÄSTERÅS SWEDEN

THE
INTERNATIONAL SUGAR JOURNAL

VOL. LXVII JULY 1965 No. 799

NOTES AND COMMENTS

World sugar statistical position.

Figures have been published recently showing estimated production this year to be well in excess of consumption forecasts and from this it has been deduced in some quarters that the balance will become an unsaleable surplus and a depressing influence on the market. C. Czarnikow Ltd.[1] comment:

"Few would quarrel with the first part of this observation. Production in the campaign year 1964/65, according to our figures, will be in the region of 63·5 million long tons. If this is to be applied against consumption during the calendar year 1965, whether this will amount to the 57 million long tons mentioned by some authorities, or the 60 million tons which we are led to consider more likely from our own calculations, there will clearly be a very considerable tonnage surplus to consumption needs.

"To arrive at an assessment of the world supply and demand situation it is necessary to take into consideration not only production and consumption but also the level of stocks. The latter is the area most open to inaccuracies, for while consumption may be projected forward over a number of years with some degree of accuracy and, to a lesser extent, production can be gauged roughly from acreages and weather reports—and in any case a great deal of statistical information is published about crops—stocks always seem to differ from their calculated levels, sometimes to a very wide degree.

"Whatever the total of stocks may have been at the commencement of the 1964/65 campaigns, and Licht may well have been close to the mark in arriving at a figure a little below ten million tons, it is clear that in many cases supplies fell to dangerously low levels. The extent to which these tonnages can be augmented before stocks can be described as surpluses is somewhat academic and moreover will vary from country to country, but in the past it has often been reckoned that a normal level of stocks would be between 10 and 13 weeks' requirements. This indicates that 12 to 15 million tons in the pipeline from producer to final consumer should be regarded as a reasonable stock level. Therefore if consumption can be stimulated to 60 million tons, the carryover into the new crop year would appear likely to be of no more than reasonable proportions".

Commonwealth Sugar Agreement.

Talks have taken place between the parties to the Commonwealth Sugar Agreement. They have been mainly concerned with the method of fixing the negotiated price under the Agreement in preparation for the usual autumn meetings.

It is reported that the talks dealt mainly with alternative methods of fixing the Negotiated Price for future years, and that useful advances have been made whereby it should be possible to obtain agreement on a method to be adopted at the usual annual talks.

* * *

National Sugar Refining Company 1964 report.

A major realignment of the Comany's operations was effected in 1964. The New York refinery was permanently closed on the 1st July and subsequently the warehousing and sugar distribution plants in Cleveland and Cincinnati were also closed. Overhead costs and carrying charges are being adjusted as quickly as possible to a single-refinery operation. The net loss for 1964 was $4,946,269. While forecasts of earnings are particularly hazardous in the sugar refining industry, projected costs for the first six months of 1965 indicate that a profit may be expected if competitive conditions in the industry permit.

Different cost conditions prevail when one refinery is operated at near capacity, as is presently the case, than when the Company was operating two refineries, often at considerably less than full capacity. In the light of these changed operating conditions, the Company re-examined the desirability of maintaining distribution and liquid sugar plants in Cleveland and Cincinnati and concluded that both should be shut down and sold. It is estimated that the loss on the disposal of these plants will be $900,000.

While the Company expects a reasonable return in the first six months of 1965 if competitive conditions in the industry permit, much work needs to be done to re-establish adequate earning power. The Philadelphia refinery is producing at lower operating costs but certainly not as low as could be achieved in a new refinery. Co-operation and understanding on the part of union employees are essential to its

[1] *Sugar Review*, 1965, (715), 99.

success. Greater productivity by each employee and willingness to adapt to automated processes will result in more favourable costs and benefit both employees and shareholders.

* * *

Sugar yields from cane and beet.

A speech by Mr. L. DECOUX to the Société Centrale d'Agriculture de Belgique was recently summarized and quoted by F. O. Licht K.G.[1] Among the points mentioned were the variation in growing period and number of ratoon crops in different parts of the sugar cane world, so that a useful table gave sugar yields in metric tons, raw value, per hectare, converted to a 12-month basis, as follows, the data being those of 1959/60:

Peru	11·8*
Hawaii	11·1
Egypt	10·6
Australia	10·1
Indonesia	9·6*
British Guiana	9·4
Barbados	8·9
Jamaica	8·9
Mauritius	7·6
Taiwan	7·4
Trinidad	7·4
Puerto Rico	6·9*
Philippines	6·7*
Fiji	6·4
South Africa	5·9
Dominican Republic	4·9
Cuba	4·7*
U.S.A.	4·4
Brazil	3·0
India	2·2*
Pakistan	1·2*

* 1958/59 data.

Corresponding figures for beet sugar calculated as the average figures for the 1955/56 to 1960/61 campaigns, are:

Holland	6·43
Belgium	5·72
Denmark	5·70
Sweden	5·66
France	4·90
U.K.	4·83
Italy	4·43
Spain	2·84

Advantages of cane (in general terms) are:

(1) An acreage cultivated with sugar cane can be used for a very long time, e.g. 25 years and more in Cuba and 8 years in Hawaii, so that cultivation costs can be spread over a long period.

(2) The semi-tropical or tropical climate gives the cane planters the guarantee of fairly constant weather conditions; rain falls regularly in a definite time and in known quantities (a dry season is followed by a wet one), and when rain is insufficient the cane can be irrigated.

(3) During a vegetation period of one or two years there are much fewer risks than during a period of 6 months as in the sugar beet cultivation in Europe.

(4) Each improvement in sugar cane cultivation has a comparatively more important effect than each improvement in sugar beet cultivation.

(5) Bagasse is used for the heating of sugar factories and consequently reduces the production costs.

There are, however, also disadvantages:

(1) The cane is sensitive to frost and drought; at temperatures slightly below freezing point the end buds are killed by frost, as a consequence of which the growth in height is suppressed or at least dependent on the uncertain growth of the lower buds.

(2) The cane has a much greater number of enemies (pests, etc.) than the sugar beet.

(3) The storage of cane after cutting or burning is very difficult.

(4) The planting costs are very high.

(5) In the long run the single-crop-farming harms the soil.

(6) The by-products of the cane crop, which consist of leaves and stalk ends, are of much less importance for agriculture than in beet cultivation.

* * *

U.S. raw sugar imports.

On the 31st March the U.S. Secretary of Agriculture set limitations of 1,250,000 short tons, raw value, on importations of raw sugar from all foreign countries as a group during the third quarter of 1965. The details of the import tonnages for individual countries[2] were announced on the 15th April, as follows:—

	Tonnage July–September	*Tonnage Jan.–September*
Argentina	30,600	60,471
Australia	147,000	147,000
Belgium	0	1,509
Brazil	59,030	164,252
British Honduras	2,600	4,342
British West Indies	39,984	109,516
Colombia	17,277	29,015
Costa Rica	13,587	36,041
Dominican Republic	124,986	385,427
Ecuador	22,848	34,258
Fiji	29,120	29,120
France	570	5,734
French West Indies	13,926	44,352
Guatemala	6,535	36,276
Haiti	0	17,723
India	43,353	100,164
Malagasy Republic	7,586	7,586
Mexico	49,196	359,469
Nicaragua	15,600	38,933
Panama	1,801	11,169
Peru	89,947	198,939
Philippines	491,708	978,289
El Salvador	6,010	17,904
South Africa	24,696	53,941
Taiwan	9,285	69,819
Turkey	0	1,357
Venezuela	2,755	2,755
		2,945,361
Final weight and polarization adjustments		4,639
	1,250,000	2,950,000

[1] *International Sugar Rpt.*, 1965, **97**, (14), 1–5.
[2] *Lamborn*, 1965, **43**, 64.

EXPERIMENTAL CONTROL OF FLOWERING IN *SACCHARUM SPONTANEUM* L. CLONES COLLECTED FROM LOCATIONS IN THE NORTHERN TEMPERATE ZONE

By J. DANIELS and M. KRISHNAMURTHI
(South Pacific Sugar Mills Ltd., Lautoka, Fiji)

Introduction

S. spontaneum clones collected at sites in the northern temperate zone usually do not flower at sugar cane breeding stations in the tropics. As temperate climate *S. spontaneum* clones contain desirable features such as cold tolerance and frost resistance, it is very desirable to introduce their germ plasm into breeding programmes. This paper describes experiments to control flowering in temperate climate *S. spontaneum*.

Literature

Panje and Srinivasin[1] studied the flowering of 341 clones of *S. spontaneum* collected between latitudes 5°N and 34°N. They found that most of these clones would not flower when displaced over 10° of latitude. However, there was a minority of clones that flowered at a wider range of latitudes. They concluded that "clones are bound with respect to flowering to definite photoperiods connected with their native latitude".

Brandes[2] studied a clone of *S. spontaneum* from Turkestan (collected at 40°N) in experimental plantings at six locations varying from 3·3°N to 38·9°N. He found that normal flowering was inhibited when *S. spontaneum* Turkestan was grown south of latitude 27°N. Brandes concluded that photoperiod played the major rôle in promoting flowering of this clone.

Experimental work recorded in the literature has aimed at the promotion of flowering in temperate climate *S. spontaneum* by altering the photoperiod.

Sartoris[3] studied *S. spontaneum* Turkestan (clones 59 Amu Darya and 60 Amu Darya) at daylengths of from 10 to 18 hr. None of the treatments was successful in promoting flowering.

Dutt and Yusuf[4] induced Assam 301 (collected at about 26°N) to flower on 9 hour days during the growth period.

Yusuf[5] induced Gerahbon (collected at 25°N) to flower on 22 hours of darkness. Clements[6], Glasziou[7] and Vijayasaradhy and Narasimhan[8] have not been able to make *Saccharum* flower on these photoperiod regimes. Lee and Lin[9] reported experiments wherein a clone of *S. spontaneum* from Formosa flowered best on a 12-hour day. However, flowering was also induced on such diverse daylengths as 9 and 15 hours. The authors of the present paper consider that the material studied by Lee and Lin may have initiated before the treatments were commenced and treatments merely influenced emergence.

Mangelsdorf[10] mentioned experiments conducted in Hawaii in which days were lengthened artificially to try to promote flowering in *S. spontaneum* from Japan and Turkmenistan. The experiments were unsuccessful.

Moriya[11] kept a Formosa clone of *S. spontaneum* vegetative on 14-hour days and achieved initiation when desired on a daylength of 13 hours 33 minutes. However the flowers did not emerge because it was too cold.

Discussion of Methods

The temperate climate *S. spontaneum* clones available for study in Fiji are listed in Table 1, along with the latitude of collection site, time of flowering in native habitat and probable daylength there at the time of initiation.

The time of initiation in the native habitat was assumed to be two months earlier than the observed flowering time. This has been found, in Fiji, to be the approximate period of delay between initiation and flowering. In this paper flowering is defined as the stage when the first spikelets open.

The maximum daylength for Lautoka, situated at latitude 17½°S, is approximately 13 hours 12 minutes. It is evident that the daylength at Lautoka is never long enough for the clones listed in Table I to flower naturally.

In a previous experiment, Daniels[12] successfully induced flowering in 8 clones of *S. spontaneum*, collected in the tropics, by photoperiod adjustments in an air-conditioned photoperiod house. The photoperiod was gradually reduced from 13 hours

[1] *Bot. Gaz.*, 1959, **120**, 193–202.
[2] *Proc. 7th Congr. I.S.S.C.T.*, 1950, 1–32.
[3] *Proc. 6th Congr. I.S.S.C.T.*, 1938, 796–801.
[4] *Curr. Sci.*, 1945, **14**, 304.
[5] *Pakistan J. Sci.*, 1950, **2**, 36–49.
[6] *Proc. 11th Congr. I.S.S.C.T.*, 1963, 533.
[7] *ibid.*, 533.
[8] *Proc. 8th Congr. I.S.S.C.T.*, 1953, 371–401.
[9] *Proc. 7th Congr. I.S.S.C.T.*, 1950, 33–43.
[10] *Proc. 9th Congr. I.S.S.C.T.*, 1956, 560–575.
[11] *Spec. Bull. Coll. Agric. Utsunomiya Univ.*, 1956, **6**, 1–63.
[12] *Proc. 11th Congr. I.S.S.C.T.*, 1963, 527–532.

15 minutes by 15 minute stops at weekly intervals; night temperature was controlled at 72°–74°F and relative humidity at 95%.

From a consideration of the estimated daylengths at initiation of the temperate climate *S. spontaneum* clones shown in Table I, it was decided that if the daylength was gradually reduced from 15 hr 15 minutes, it must pass through the critical photoperiod of each clone. In case it is necessary to have lengthening days prior to the shortening daylight, it was decided to gradually increase the daylength up to the 15 hours 15 minutes starting point. The night temperature chosen was 70°F which is the approximate minimum temperature at Tokyo in the assumed months of initiation.

Table I

Temperate zone *S. spontaneum* in S.P.S.M. Ltd. Variety Collection at Lautoka, Fiji

Clone	*Country where collected*	*Latitude at which collected*	*Date of flowering where collected*	*Probable daylength at initiation*
Tainan	Formosa	23°N	10th August	13 hr 33 min
Okinawa No. 1	Okinawa	26°N	? August	13 hr 40 min
Hasuda	Japan	*ca.* 35°N	10th August	14 hr 30 min
Tokyo	Japan	36°N	10th August	14 hr 30 min
US4515	Turkmenistan	*circa* 40°N	1st August	15 hr 00 min

Materials and Methods

During February, 1961, the five clones listed in Table I were each planted in six drums of soil. The drums were of 11 gallons capacity and filled with riverbank loam. Sulphate of ammonia was applied at the rate of approx. 2 oz per drum, two weeks after planting. The canes were watered daily from planting until the conclusion of the experiment.

On August 14, 1961, three treatments were set up, with two drums of each clone allotted to each treatment.

Treatment No. 1. The drums were moved into the photoperiod house, described by DANIELS[12], on trolleys at 4 p.m. each day and rolled out at 7 a.m. each morning. Daylength was adjusted by internal lighting as follows:—

14th August—20th August 1961	14 hr
21st August—27th August 1961	14½ hr
28th August—3rd September 1961	15 hr
4th September—10 September 1961	15¼ hr

The daylength was then reduced by 15 minutes per week. Night temperature was adjusted to 70°F, but the actual range obtained was 70–72° F. Night humidity was controlled at 95%.

Treatment No. 2. The same as Treatment No. 1, except that the experiment was conducted in the external night lighted area described by DANIELS[12] with no temperature or humidity control.

Treatment No. 3. Two drums of each variety were left continuously in an unilluminated outside location as controls.

Results

Treatment No. 1. (Induction in photoperiod house.) Tokyo and Tainan were the only varieties to flower. Tokyo flowered in two flushes. On 26th November 1961, 3 stalks flowered, and at the end of December all remaining mature stalks flowered. There was no flowering in the intervening period. Tainan flowered only at one time, the first flowers opening on 5th January 1962.

Treatment No. 2. (Induction in external night lighted area.) Tainan was the only variety to flower. These flowers emerged one week later than those in Treatment No. 1. Flowering was profuse.

Treatment No. 3. (Controls.) None of the controls flowered.

Discussion

Tokyo flowered at two widely separated times under controlled conditions. It is thought that:—

(1) three stalks initiated when passing through critical daylength while the daylength was increasing and these emerged in November.

(2) the main flowering was initiated at critical daylength on the decreasing photoperiod, flowering commencing in late December.

This seems a reasonable hypothesis as recent observations have shown that some of the *S. spontaneum* clones that flower naturally in Fiji flower sparsely all summer if they are irrigated regularly. However they flower profusely during the shortening daylengths of autumn. Apparently decreasing daylengths are more efficacious than lengthening daylengths for initiation and emergence. Toyko did not flower at all in the external night lighted area although it flowered well when the night temperature and humidity were controlled inside the house. This indicates a possible temperature effect. Temperature readings for Lautoka Agricultural Experiment Station during the course of the experiment are given in Table II.

Table II

Meteorological data recorded at Lautoka Agricultural Experiment Station August 1961—December 1961

	Average air temperature		*Lowest Minimum air temperature*	*No of days with air temperature under 65°F*	*9 a.m. relative humidity*	
	Max.	*Min.*			*Average*	*No. of days under 70%*
August 1961	81·7	66·4	58·4	12	72	16
September 1961	83·9	71·7	68·5	Nil	74	10
October 1961	82·9	69·1	61·5	5	66	21
November 1961	83·8	72·1	69·0	Nil	73	10
December 1961	85·2	73·4	65·0	1	77	5

It can be seen that in October, the probable month of initiation, temperature and relative humidity were low. COLEMAN[13] has shown that night temperatures below 65°F inhibit flowering in commercial varieties. In October the minimum temperature was below 65°F on five occasions. Table II also shows that 9 a.m. humidity was below 70% on 21 occasions during October. DANIELS[12] found that relative humidity needed to be over 95% for profuse flowering of tropical *S. spontaneum* in an air-conditioned photoperiod house. It is probable that the low temperature and humidity during October interfered with the flowering of Tokyo, and possibly some of the other clones, in the external night lighted area.

Tainan flowered well in both treatments indicating that it is not sensitive to temperature or humidity fluctuations. Hasuda, Okinawa No. 1 and US4515 did not flower in either treatment. GLASZIOU[14] has suggested that they did not flower because the maximum daylength used was not long enough, insufficient account being taken of twilight which is considerable in northern temperate zones in mid-summer. Perhaps daylengths of up to 18 hours are necessary. SARTORIS[3] gave photoperiod treatments up to 18 hours but did not obtain flowering; however, there was no temperature control in his experiments. As Tokyo flowered when temperature was controlled but not otherwise, it is possible that Hasuda, Okinawa and US4515 have precise night temperature requirements for flowering as well as critical photoperiods.

SUMMARY

Two clones of *S. spontaneum* (Tainan and Tokyo) from northern temperate zones were successfully induced to flower by reducing the photoperiod from 15 hr 15 minutes at a constant night temperature of 70–72°F and relative humidity of 95%. Tainan also flowered with only photoperiod control.

ACKNOWLEDGMENTS

The authors wish to thank the South Pacific Sugar Mills Ltd. for permission to publish the results of this investigation.

[13] *Rpts. Hawaiian Sugar Tech.*, 1963, 108–109.
[14] Personal communication, 1962.

AGRICULTURAL ABSTRACTS

Damage to plant cane from broadcast application of crude BHC dust. R. B. MOLLER. *Cane Growers' Quarterly Bull.*, 1964, **28,** 40–41.—It is explained how damage to planting setts and young plants generally takes place through faulty application or overdose and how this may be avoided. Severe root-stubbing, caused by excessive BHC, is illustrated.

* * *

Phosphate requirements of new soils. R. B. MOLLER. *Cane Growers' Quarterly Bull.*, 1964, **28,** 42–43.—In Queensland areas are now being developed for cane growing which would have been condemned as unsuitable a decade ago. Many of these are on ridges on poor sandy soils very deficient in phosphate and also potash. The importance of placing superphosphate as near to the young cane roots as possible is stressed. The Bureau of Sugar Experiment Stations has devised a series of fertilizer mixtures suitable for any of these soils.

* * *

Land drainage demonstrated at Rocky Point. C. G. STORY and C. L. TOOHEY. *Cane Growers' Quarterly Bull.*, 1964, **28,** 44–47.—One of the main problems facing cane growers in the Rocky Point Mill area is that of prolonged waterlogging after heavy rain. Improved drainage and how this may be brought about is here described. Many flat, low lying areas, have, in fact, been converted into productive cane farms through efficient large scale drainage.

Greyback Grub control: amended recommendations. G. WILSON. *Cane Growers' Quarterly Bull.*, 1964, **28,** 48–49.—These recommendations are intended as an amendment to a pamphlet issued in 1962 by the Bureau of Experiment Stations, Queensland, and entitled "Greyback grub control by means of BHC and other insecticides". Crude BHC dust has been found more lasting than the refined forms. "Aldrin" has given erratic results while "Lindane" has poor lasting properties in the soil. "Heptachlor" and "Dieldrin" are effective only against the Greyback grub.

* * *

Manual of cane growing. ANON. *Cane Growers' Quarterly Bull.*, 1964, **28,** 58.—A new edition of this manual, the standard textbook for Queensland cane growers, is scheduled to appear about the middle of 1965. Produced by the Bureau of Sugar Experiment Stations, it first appeared in 1953. This new edition will contain much new matter and will be issued free to all holders of cane assignments in Queensland.

* * *

Advice on cane planting. V. E. ZUNCKELLER. *Bol. Informativo Copereste* (São Paulo), 1964, **3,** (24), 2 pp. The desirability, for climatic reasons, of planting sugar cane in September-October is stressed. The names of some desirable, rapidly maturing varieties are given.

SUGAR CANE BREEDING IN THE WEST INDIES

THE 30th Annual Report, 1962–63, of the British West Indies Central Sugar Cane Breeding Station (Groves, St. George, Barbados) and Barbados Sugar Cane Variety Testing Station (Codrington, St. Michael, Barbados) has recently appeared. The development and functioning of the enlarged Cane Breeding Station at Groves proceeded smoothly and satisfactorily. Thanks to the increased space available it has been possible to establish more extensive plots of shy-arrowing varieties. It has also been possible to establish further ratoon plots of most varieties. Additional land, at present under commercial cane, is to be brought into use for an expanded seedling programme from new wild clones, and for experiments not easily carried out on land loaned by plantations.

The breeding programme for the season was carried out by using Hawaiian solution (sulphurous acid/phosphoric acid) entirely for the first time. It was considered this method proved to be easier to carry out but there are problems remaining to be solved before it may be called a fully satisfactory routine.

The Variety Testing Station continued to serve a number of foreign contributors, including Venezuela, this country having rejoined after a lapse of several years. There is a list in the report of those countries, about 20 in all, to which varieties were distributed during the year. Jamaica and British Guiana received one cutting of each of the varieties of the B62′ series with certain exceptions, i.e. those selected for breeding only. Martinique and Guadeloupe also received extensive collections of the B62′ series, 68 and 114 varieties respectively. By way of contrast only one variety went to the United States, viz. B 45151. Surinam received 7 and Portugal (for Angola) 5, the same number as the Congo Republic.

Full details are given of the cane breeding, seedling raising and preliminary eliminations, numbers and figures being supplied in appendix 1-3 in the report. Out of 215 crosses attempted, 119 yielded seedlings for commercial testing, with a further 10 for breeding purposes only. A feature of the programme was the large number of small "families", even though the ripening arrows had appeared fairly satisfactory. Only 17 "families" contained over 1000 seedlings. Pollination was suspected and some checks on the humidity of Groves were planned for the following season.

The section on "Varietal trends in contributing territories" supplies convenient data for making interesting comparisons concerning cane growing countries in the Caribbean region. Figures of estate acreages from 7 different countries are given. In Jamaica the variety B 4362 showed a further increase from 37% to 40%, while B 41227 fell from 33% to 28%. However, B 41227 remained the leading variety by a handsome margin in both British Guiana and Trinidad with 50·4% and 58·4% respectively. Besides in Jamaica, B 4362 was the leading variety with the Central Romana Corporation of the Dominican Republic, scoring 30%, B 41227 being second with 20%.

F.N.H.

Agricultural Abstracts

Six major cane varieties. ANON. *Cane Growers' Quarterly Bull.*, 1964, **28,** 60.—Six sugar cane varieties accounted for nearly 9 million tons of Queensland's 1963 crop, or 77% of the total tonnage. These were: Pindar, N:Co 310, Q57, Trojan, Q50 and Q58.

* * *

Current Johnson grass investigations and recommendations in the Burdekin area. I. T. FRESHWATER and J. WRIGHT. *Cane Growers' Quarterly Bull.*, 1964, **28,** 63–65.—Previously much hope had been placed on repeat applications of "Dalapon" (8 lb/acre) and TCA (32 lb/acre). Now "Hyvar X", a weedicide of the uracil group, shows most promise (rate 20 lb/acre). It is necessary to get foliage thoroughly wetted. A programme of cultural operations plus chemical control is outlined.

* * *

The value of early fertilizing. ANON. *Cane Growers' Quarterly Bull.*, 1964, **28,** 67.—The value of the correct placing of fertilizer in the soil at planting time is well illustrated by a photograph in which the last rows of a field were not fertilized at planting time, supplies of fertilizer having run out, but were fertilized later on the surface. Growth appears less than a third of that in the rows fertilized at planting time.

* * *

Whitish clay soils. ANON. *Cane Growers' Quarterly Bull.*, 1964, **28,** 68.—Some of the land now being devoted to sugar cane in Queensland consists of a thin whitish clay soil overlying a yellow clay sub-soil. Advice on how to get such soils into good heart for cane is given. With careful handling and the use of fertilizers and modern varieties they can produce good crops. Only a little of the clay sub-soil, about an inch, should be ploughed up at any one time.

* * *

An uncommon leaf-eating caterpillar. G. WILSON. *Cane Growers' Quarterly Bull.*, 1964, **28,** 69–70.—An account or description is given of this cane pest at Mossman in Queensland—a large green caterpillar, 2 inches long (*Melanites ledabankia*). It is not regarded as a serious cane pest.

BHC and lime do not mix. ANON. *Cane Growers' Quarterly Bull.*, 1964, **28,** 71.—The warning is given that BHC and lime should never be applied jointly to the soil, or within a short space of each other. Chemical interaction results in a product detrimental to plant growth, including cane. The insecticidal value of the BHC is also lost.

* * *

Increased deductions for dirty cane. ANON. *Producers' Rev.*, 1964, **54,** (9), 15.—An increase in the deduction from 1s to 3s per ton for badly topped, trashy or dirty cane and 2s to 6s for cane very bad in this respect has been granted to Rocky Point mill owners in Queensland. This has been done in the hope of inducing a small minority of growers, who persistently supply dirty cane, to mend their ways.

* * *

Ratoon crops yield effect. ANON. *Producers' Rev.*, 1964, **54,** (9), 17.—Figures are given for plant cane crops and 1st and 2nd ratoon crops over long periods and in 3 different parts of Queensland.

* * *

Mechanical harvesting's part in sugar industry's success. ANON. *Producers' Rev.*, 1964, **54,** (9), 19. Like the Queensland sugar industry itself, mechanical harvesting has developed gradually but progressively. The details and attributes of the "Harvestall" cane harvester (developed by Scott Bros. of Bundaberg) are outlined.

* * *

Sugar production in the Portuguesa area of Venezuela. ANON. *Bol. Inst. Fomento Productividad Azuc.*, 1964, **1,** (5), 40 pp.—This constitutes a study of all aspects of sugar cane cultivation and production in a cane growing area of Venezuela between the rivers Guache and Sarare, at an altitude of 140-220 metres (68° 45′—69° 20′ E and 9° 10′—9° 40′ N). Details regarding climate, rainfall and soils are included.

* * *

Culture of sugar cane for sugar production in Louisiana. L. P. HEBERT. *U.S. Dept. Agric. Handbook* 262, 1964, 1–40.—This handbook contains information on soils, weather, growing conditions and cultural practices generally. Yields of cane and sugar from 1926 to 1960 are given, also information on major pests and diseases, weed control and mechanical harvesting.

* * *

Irrigating fields with sugar factory effluent. A. N. PARKHOMENKO. *Sakhar. Prom.*, 1964, **38,** 748–751. Details are given of the preparation of fields for such treatment and a description is given of a scheme where effluent from Yagotinskii sugar factory (Ukraine) is irrigated over an area of 527 ha at the rate of 7900 cu.m./day during a 150-day campaign. To reduce the large amount of solid matter, mainly lime substances (50% of dry matter) which would adversely affect the growth of crops in black earth, the waste water is first fed to settling ponds. Details are given of the irrigation network and of the costs of the scheme. Apart from replacing mineral fertilizers, the effluent is claimed to raise the harvest capacity by 65–70%.

* * *

Hurricane Hilda. L. L. LAUDEN. *Sugar Bull.*, 1964, **43,** 20, 29–30.—The effect of the hurricane of 3rd and 4th October 1964 on the cane crops of different districts is described. Virtually all the cane was blown over with the exception of one area. However, mechanical harvesters, some operating at night as well as in the daytime, dealt successfully with the crop. Lodging reduces the sugar content about one and one half points below that of erect cane. Lodged cane, like erect cane, continues to gain in sucrose content during the remainder of the season.

* * *

Green manuring of cane with *Crotalaria juncea*. J. MIOCQUE. *Bol. Informativo Copereste* (São Paulo), 1964, **3,** (23), 1–2.—The advantages of sunn hemp or sann hemp as a green manure for cane are discussed. Its ability to produce a large quantity of green matter in a relatively short time is emphasized.

* * *

Time of planting with sugar cane. F. O. BRIEGER. *Bol. Informativo Copereste* (São Paulo), 1964, **3,** (24), 2–3.—Reasons are given why September-October planting of sugar cane is to be preferred to other seasons (in São Paulo).

* * *

Mechanical harvesting of sugar beet. ANON. *Pub. Tech. Inst. Belge pour Amél. Betterave*, 1964, (3), 89–138.—An account is given of an international symposium on sugar beet in Brussels in February 1964, when the subject of mechanization was to the fore and speakers from France, West Germany, Holland and Belgium recorded the position in their own countries.

* * *

Mechanical topping of sugar beet. M. MARTENS. *Pub. Tech. Inst. Belge pour Amél. Betterave*, 1964, (3), 165–178.—An account is given of preliminary trials in Belgium, during the 1963 season, with American equipment, viz. the "Speedy" beet top harvester. Rotating blades cut away the top (in fragments) so that beets must all be growing at a uniform level.

Results of 1963 tests with polished and graded sugar beet seed. N. ROUSSEL. *Pub. Tech. Inst. Belge pour Amél. Betterave*, 1964, (3), 151–164.—Tests with commercial seed of 18 varieties of sugar beet are recorded, as well as a mass of other data in a series of tables.

* * *

Use of "Citowett" with "Pyramin" for weeds in sugar beet. M. MARTENS. *Pub. Tech. Inst. Belge pour Amél. Betterave*, 1964, (3), 179–192.—Under dry conditions the action of "Pyramin" as a post-emergence weed-killer is improved by the solvent "Citowett." Doses of "Pyramin" can be reduced. The use of "Citowett" on very young beets (cotyledon stage) is dangerous.

* * *

Sugar cane diseases in Ivory Coast, Dahomey and Togo. P. BAUDIN. *Agron. Trop.*, 1964, **19,** 747–755. The findings of a phytosanitary mission to these territories early in 1964 is recorded. Each of these countries is dealt with separately and recommendations made in regard to future treatment of cane. In Ivory Coast ratoon stunting disease is all-important and was recorded on several varieties. In Dahomey red rot (*Physalospora tucumanensis*) and streak (a virus) are the main diseases. In Togo and Dahomey recently planted cane in cleared forest land suffers from termite attack at the base.

* * *

Economic structure of the sugar beet industry in the United States, its relationship and influence on the Louisiana sugar industry. J. N. FAIRBANKS. *Sugar Bull.*, 1964, **43,** 54–57.—The distribution of the sugar beet industry in the United States and its growth in recent years is briefly outlined. The industry started in 1879 whereas cane was first grown commercially in Louisiana as far back as 1795. By 1963 home-grown beet sugar was responsible for a 28·2% share of the U.S. sugar market while home-grown cane accounted for 10·2%. Unlike the cane growers, beet growers usually produce several other crops and live stock. Other differences between the two industries are discussed.

* * *

Sugar cane and viable seed production research. A. HUSSAIN. *Rpt. Ayub Agric. Res. Inst.* (Lyallpur, West Pakistan), 1962, pp. 5–6.—Reference is made to the success that has been achieved in producing viable sugar cane seed in West Pakistan since independance. Most cane varieties have been induced to flower by growth at different altitudes (in the Murree Hills) and irrigation-cum-light treatment.

* * *

The effect of a trash mulch on the growth and yield of ratoons. M. S. GILL. *West Pakistan J. Agric. Res.*, 1963, **1,** (2), 149–156.—This work, carried out at Lyallpur, was to ascertain the best methods of treating ratoons, now popular for early yield, under prevailing conditions (canal irrigated areas). Mulching, fertilizing and cultivation were compared. A trash mulch was found to reduce overall labour costs, to suppress weed growth, reduce borer attack and to conserve soil moisture—all resulting in increased yield of cane.

* * *

A morphological description of the sugar cane variety Co 547. M. S. CHOUDHARY and A. M. KHAN. *West Pakistan J. Agric. Res.*, 1963, **1,** (2), 157–162.—Co 547 is regarded as the most promising variety in the Hyderabad region and this detailed description is given so that it should not be confused with other similar varieties.

* * *

Growth studies of sugar cane in the Hyderabad region. M. S. CHOUDHARY and A. M. KHAN. *West Pakistan J. Agric. Res.*, 1963, **1,** (3), 18–26.—Stalk elongation, leaf and tiller formation and other characters were closely studied and results recorded in tabular form. The conclusion was reached that fertilizing should be completed by the end of May and irrigation made at 7–10 day intervals during May, June and July.

* * *

A review of recent investigations of sugar cane diseases at the Houma station. N. ZUMMO, E. V. ABBOTT and R. L. TIPPETT. *Sugar Bull.*, 1964, **43,** 70–77.—An account is given of recent research on the most troublesome sugar cane diseases in Louisiana, viz. ratoon stunting disease and mosaic, both due to viruses, and red rot (*Physalospora tucumanensis*). Tables show the degree of susceptibility of the different varieties of cane in cultivation and of the effects of hot air *versus* hot water treatment in the case of ratoon stunting disease.

* * *

The typical Australian cane farm. ANON. *Producers' Rev.*, 1964, **54,** (10), 17.—The typical farm is said to consist of about 80 acres, 72 being cultivated, and to conform to the Australian pattern of one-man ownership and operation. About 18 acres might consist of plant cane, 36 acres of first and second ratoons and 18 acres of fallow land being prepared for replanting. Each farm is a self-contained unit with the family residence, usual farm buildings, cane cutters' barracks, farm implements and in some cases irrigation plant. Mechanization is extensively practised.

* * *

Precision irrigation. J. P. HUDSON. *Producers' Rev.*, 1964, **54,** (10), 25.—Although much is known about the application of water to crops, there is an uneasy feeling that water may be misused in warm climates. It is considered that all stages of the movement of water in the soil should be more closely studied, also movement from soil to roots, roots to stem and leaves and leaves to atmosphere. It is thought better yields might be obtained, especially in the dry tropics, if irrigation control could be more closely related to soil, plant and weather conditions.

A METHOD OF DETERMINING A "CRYSTAL REGULARITY INDEX" FOR WHITE SUGAR

By S. HILL
(Tate & Lyle Refineries Ltd., Keston, Kent).

IN this article the word "regularity" will be used to express the extent to which crystals of sucrose conform to the natural crystallographic shape, and the extent to which they are free from conglomeration. Regularity is an important consideration in the overall estimate of white sugar quality and it is desirable to have a method of defining it quantitatively.

A numerical specification of the regularity of a sample of sugar can be arrived at by classifying the individual crystals of the sample according to an agreed scale. Regularity can be considered to vary from 100% for a set of perfect crystals to zero for a set of conglomerates. The regularity of a single crystal can, of course, take any value in the continuous range between crystallographic perfection and complete conglomeration, but experience with the method to be described indicates that it is sufficient to classify the individual crystals into three grades—good, moderate and conglomerated.

Suppose that we take from a batch of white sugar a controlled sample consisting of a predetermined number of crystals. A numerical estimate of the regularity of the batch can be derived by attaching two marks to every good crystal in the sample and one to every moderate crystal, with none for the conglomerates. For convenience the total obtained, expressed as a percentage of the maximum obtainable, will be called the "Crystal Regularity Index".

Assessment can be performed more easily on a photograph of the sample than on the sample itself. An ordinary photograph of a random sample is not satisfactory, firstly because the disorderly distribution of the crystals makes counting difficult, secondly because rules must be formulated to eliminate the effect of crystal size. We shall see later that an estimate of regularity is sensitive to the sizes of the crystals chosen for inspection.

The following method of assessment has been found to give a satisfactory index of regularity and the amount of work involved is not unduly great. The method will be described with reference to three batches (A, B and C) of white sugar.

The first operation is the determination of the mean aperture (M.A.) of the batch by an ordinary sieve analysis on a representative sample. Then four successive sieves are taken from a standard screen series—for example the B.S.S. series—such that two of the sieves have apertures that are greater than the measured M.A. and two have apertures that are smaller. If, for example, the M.A. is 0·025 inches the sieves would be B.S.S. numbers 18 (aperture size 0·0336 in), 22 (0·0275 in), 25 (0·0236 in) and 30 (0·0197 in). This situation is shown in Fig. 1, where the C.V. of the crystal size distribution is 30%. These sieves are then used to prepare small samples of "through 18 on 22" (18/22) and "through 25 on 30" (25/30) crystals. For this separation the sieves should by very lightly loaded and they should be shaken by hand until the size classification is substantially complete. Subsequent manipulation of the sample is then much facilitated.

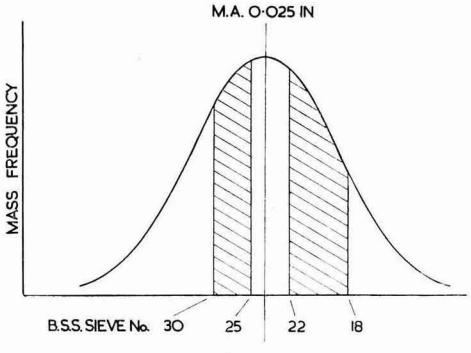


Fig. 1

Consider the 25/30 crystals. A piece of sieve mesh is taken which is one grade coarser in the standard screen series than the coarser of the two sieves which define the crystal size. For the 25/30 crystals a piece of B.S.S. number 22 mesh would be used. The apertures of this mesh—the distributing mesh—are sufficiently big to accommodate any 25/30 crystal easily, but they are too small to accept two such crystals together. The piece of mesh can conveniently contain 1000 apertures (say 25 × 40) and it should be stiffened with a rigid rim. A piece of transparent self-adhesive tape is pressed against the underside of the mesh and the crystals are distributed over the mesh with a few strokes of a soft brush. If the mesh is now inverted, the crystals in the apertures will adhere to the tape while the unattached crystals will fall away. Any unoccupied apertures can be filled if this is considered desirable. The adhesive tape is peeled away with the adherent crystals regularly arranged, and it is applied to a glass plate so that the crystals are retained between the tape and the glass. Figs. 2a and 2b show a B.S.S. No. 22 distributing mesh and the distributed sample. After repeated use the distributing meshes should be cleaned with a suitable solvent.

The distributed sample is photographed for assessment. Unless copies of the photographs are required there is no need to make negatives. Satisfactory "shadowgraphs" can be produced by placing the array of crystals in the object plane of a photographic enlarger. Fig. 5a was made in this way. It is advantageous to adjust the magnification of the enlarger according to

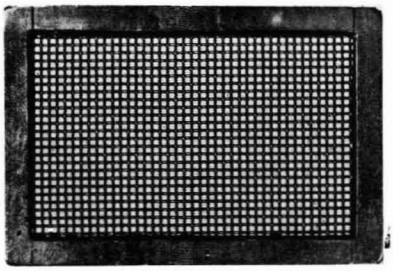


Fig. 2a. Distributing mesh, B.S.S. No. 22.

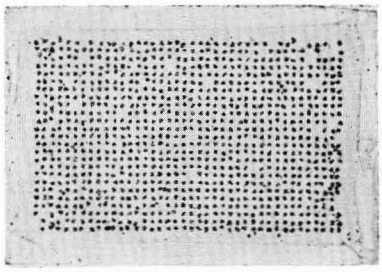


Fig. 2b. Distributed sample, size 25/30.

the size of the distributing mesh so that the inter-crystal spacing in the photograph has a standard value. The recommended spacing is three crystals per inch, so for B.S.S. sieve number 16 the magnification would be 16/3. A photograph can conveniently contain about 15 rows of crystals with rather more than 20 crystals per row.

The photographed crystals are now classified as good, moderate and conglomerated, and in order to establish uniformity of judgment the crystals are compared with the standards shown in Fig. 6.

By comparison with the standards the observer classifies 100 crystals. Good crystals are given two marks and moderate crystals one, and as there are two photographs per batch the maximum number of marks is 400. Assessment is necessarily somewhat dependent on the observer but reasonable agreement between observers can be achieved. If a series of comparative measurements is to be made it is desirable that the assessments be made by one observer only. In order to avoid bias it is essential to select the 100 crystals for classification according to a systematic procedure. The writer's method is to mark 20 crystals in each of the 1st, 4th, 7th, 10th and 13th rows.

Table 1 shows the relevant characteristics of the three batches of sugar, A, B and C, and the details of the sieves and meshes used.

Figs. 3a to 5b are "shadowgraphs" of the samples sifted and distributed according to Table 1. For economy of space only one of these (Fig. 5a) is reproduced in full; the remaining photographs are reproduced in part only.

Table I

Batch	*M.A. (inches)*	*Separating sieves B.S.S. No.*	*Distributing mesh B.S.S. No.*
A	0·025	18, 22 25, 30	16 22
B	0·029	16, 18 22, 25	14 18
C	0·029	16, 18 22, 25	14 18

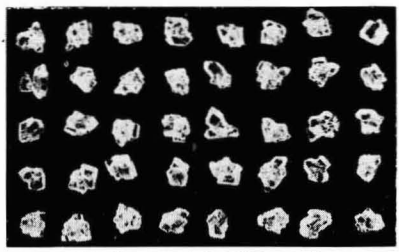


Fig. 3a. Batch B, 16/18 crystals

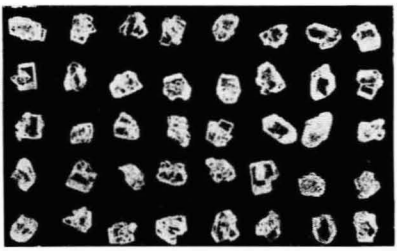


Fig. 3b. Batch B, 22/25 crystals

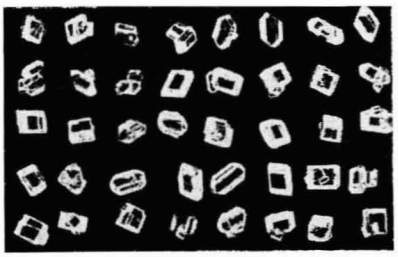


Fig. 4a. Batch C, 16/18 crystals

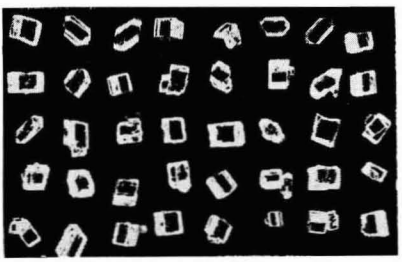


Fig. 4b. Batch C, 22/25 crystals

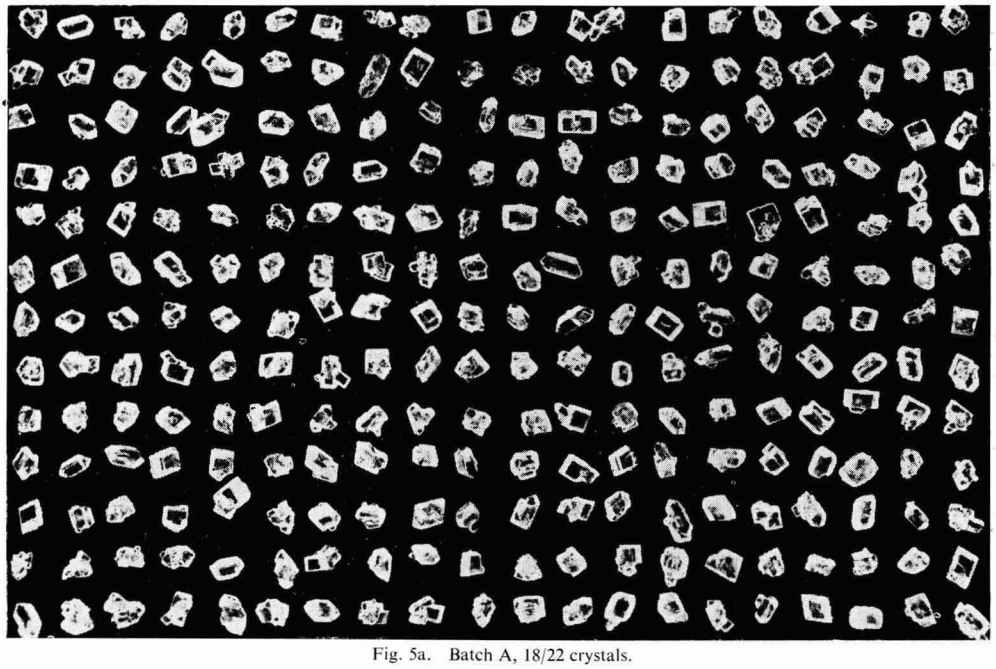


Fig. 5a. Batch A, 18/22 crystals.

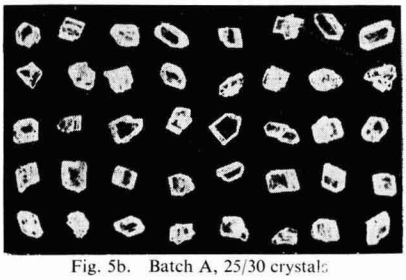


Fig. 5b. Batch A, 25/30 crystals

To test the reproducibility of the method the six original photographs were assessed by each of four observers. Each observer made two assessments. Several days elapsed between assessments and on both occasions the photographs were randomized and coded to eliminate bias. The numerical estimates are given in Table 2.

The average percentages are in accordance with the general appearance of the samples.

There are appreciable differences between the levels of assessment of the different observers, but these are small compared with the differences between batches.

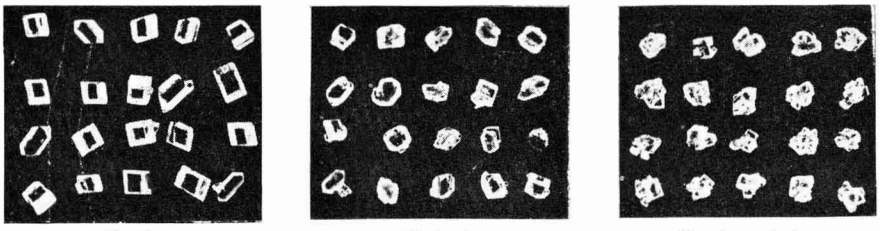
There is no significant difference between observers concerning the order of regularity of the samples. Replication is fairly good; the standard deviation of an estimate of one sample is 4·3%.

In all assessments the smaller crystals have obtained a greater regularity figure than the corresponding larger crystals. This applies to nearly all of the batches of white sugar which have been subjected to this procedure.

Table II

Percentage assessments

Batch		A		B		C		*Observer means*
	Size of Sample	18/22	25/30	16/18	22/25	16/18	22/25	
Observer I	1	39·5	45	14·5	26·5	71	75·5	45·4
	2	44·5	48	15	26·5	67	72·5	
Observer II	1	28·5	41	7	20	58	77	35·8
	2	21·5	32·5	5	7	54·5	77	
Observer III	1	32·5	41·5	3	29	64	72·5	44·1
	2	36·5	55	8	37·5	68·5	81	
Observer IV	1	29	51·5	7·5	28·5	63	87·5	42·8
	2	27	47	6·5	19·5	65·5	81·5	
Sample Mean		32·4	45·2	8·3	24·3	63·9	78·1	
Batch Mean		38·8		16·3		71·0		



Good Moderate Congiomerated

Fig. 6. Regularity standards

ISOLATION OF PLANTEOSE AND NYSTOSE FROM CANE FINAL MOLASSES

By W. W. BINKLEY

(New York Sugar Trade Laboratory, 37 Warren Street, New York, N.Y., 10007, U.S.A.)

THE production of sucrose is the outstanding chemical and economic contribution of the sugar cane. This plant engages also in other carbohydrate syntheses of wide diversity, ranging from simple sugars and oligosaccharides[1] to starches, pectins and gums[2]. While sucrose is often the source of the hexose moieties in these substances, this sugar serves also as the foundation unit of certain oligosaccharides as well. Many of these carbohydrates, in addition to sucrose, survive the milling process and appear in the final molasses. In the continued utilization of modern chromatography we have now isolated from this molasses a second galactosylsucrose, planteose, and a fructosyl-1-kestose, nystose[3].

EXPERIMENTAL

Materials.—The isolation from cane final molasses of a non-sucrose oligosaccharide concentrate (designated Fraction B-90R, representing 1 kg of molasses) has been published[1]. The yields of residual syrup from effluent Cuts 111 to 117 of the elution chromatography of Fraction B-90R were 326, 248, 171, 144, 166, 167, and 118 mg, respectively. Molisch and Benedict reagents revealed that these residual syrups contained non-reducing sugars. Paper chromatography of the acid hydrolysates from these syrups indicated the probable presence of glucose, fructose and a trace of galactose. Cut 117 yielded 32 mg of crystals which gave a positive reaction when tested for inositol[4].

Exploratory Chromatography and Electrophoresis on Paper of Cuts 111–117 from the Column Chromatography of Fraction B-90R

Portions of the residual syrups from Cuts 111–117 were chromatographed on Whatman No. 1 filter

[1] BINKLEY: *I.S.J.*, 1964, **66**, 46, 185.
[2] BINKLEY & WOLFROM: *Advances in Carbohydrate Chem.*, 1953, **8**, 293.
[3] BINKLEY & ALTENBURG: *I.S.J.*, 1965, **67**, 110–112.
[4] SCHERER: *Ann.*, 1852, **81**, 375.

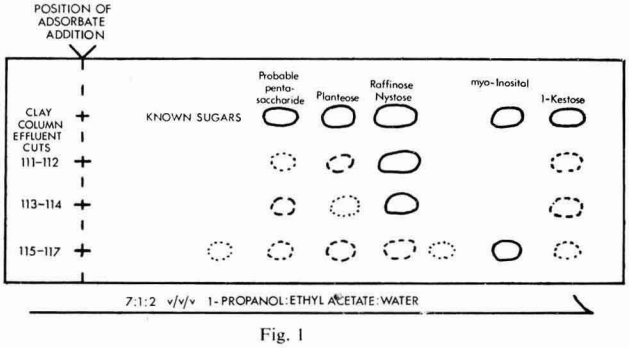


Fig. 1

paper. The chromatogram was developed at 20°C for 113 hr with 7:1:2 v/v/v 1-propanol:ethyl acetate: water and sprayed with α-naphthol-phosphoric acid[5] and sodium metaperiodate-potassium permanganate[6] reagents (Fig. 1). The probable presence in these cuts of 1-kestose, raffinose or nystose, planteose, three unidentified oligosaccharides and *myo*-inositol was indicated.

Portions of the residual syrups from Cuts 111–117 on Whatman No. 3 filter paper were subjected to electrophoresis at 12°C for 4 hr at 2000V in a 0·05M borate buffer at pH 9·2. The probable presence in these cuts of planteose, raffinose, 1-kestose, nystose, neo-kestose and eight additional substances detected

Table I

Zone locations and yields from the thick paper chromatography of cuts 111–117 of the clay column chromatography of Fraction B-90R

	*Zone Location cm**	*Cuts* 111–112, *mg*	*Cuts* 113–114, *mg*	*Cuts* 115–117, *mg*	*Principal Component*
V	16–18	—	—	1·6	
IV	19–22	—	2·7	1·5	
III	21–25	3·7	5·8	2·3	Pentasaccharide(s?)
II	28–33	10·1	4·3	5·1	Planteose
I	34–40	37·6	17·3	7·7	Nystose
	Effluent	47·1	73·8	89·8	
	Total	98·5	103·9	108·0	
Added Adsorbate		100 mg	104 mg	128 mg	

* Distance from the position of adsorbate addition.

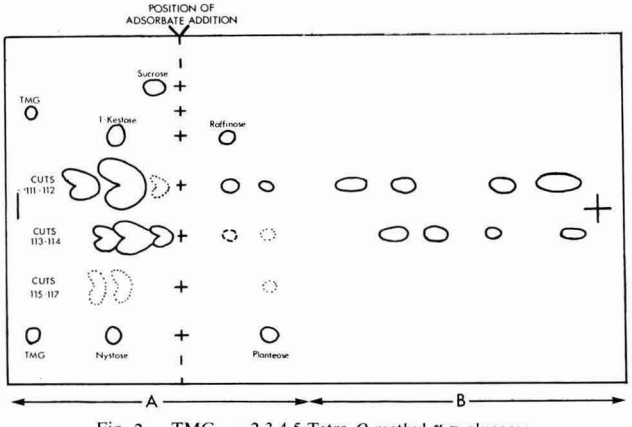


Fig. 2. TMG = 2,3,4,5-Tetra-*O*-methyl-α-D-glucose; A: sprayed with α-naphthol-H_3PO_4; B: sprayed with $KMnO_4$-$NaIO_4$.

by the permanganate-periodate spray reagent was strongly suggested (Fig. 2).

Chromatography on Thick Paper of Cuts 111–117 *from the Column Chromatography of Fraction B-90R*

(A) *Chromatography of Combined Cuts* 111 *and* 112. A 100 mg portion of the combined Cuts 111 and 112 in 2 ml of aqueous methanol was deposited with a streak applicator at a selected position on a 23 × 45 cm sheet of Whatman No. 17 filter paper. The descending chromatogram was developed at 20°C with 550 ml of 7:1:2 v/v/v 1-propanol:ethyl acetate: water, 6 to 7 days being required. Zone locations were achieved with α-naphthol-phosphoric acid reagent sprayed on guide strips cut from the lengthwise edges of the chromatogram. The yields of residual syrup from the elution of these zones with water are shown in Table I.

(B) *Chromatography of Combined Cuts* 113 *and* 114. A 104 mg portion of the combined Cuts 113 and 114 was chromatographed on thick paper in the manner just described for the combined Cuts 111 and 112. Zone locations and adsorbate recoveries are recorded in Table I.

(C) *Chromatography of Combined Cuts* 115–117.—An amount of 128 mg of the combined Cuts 115–117 was chromatographed on thick paper exactly as described for combined Cuts 111 and 112 (see Table I).

The yields of residual syrup recovered from the developer flowing off the bottom edge of the paper chromatograms are listed in Table I. Paper chromatography indicated the probable presence of 1-kestose in the effluent syrups from Cuts 111–114, 1-kestose and *myo*-inositol in that from Cuts 115–117. High voltage paper electrophoresis[7] revealed the presence in these syrups of at least six additional substances sensitive to the periodate-permanganate spray reagent.

(D) *Isolation of Nystose.*—Nucleation at 25–27°C with nystose[3] of an aqueous methanol solution of 34 mg of the Zone I residual syrup from the thick paper chromatography of combined Cuts 111 and 112 yielded 27·1 mg of elongated prisms. Recrystallization from the same solvents produced crystals which melted at 129–131°C, mixed melting point with an authentic specimen of nystose being unchanged, $[\alpha]_D^{20}$ + 10·7° (c 2, water); $R_{sucrose}$ 0·37–0·38 and $M_{sucrose}$ 0·63–0·64 were in good agreement with those for nystose (Fig. 3). The infra-red spectrum and X-ray powder diffraction pattern of these crystals were identical to those for nystose. These crystals reacted as follows: Molisch-positive, Benedict-negative. Paper chromatography revealed the probable presence of 1-kestose, sucrose, glucose and fructose among the products of the incomplete acid hydrolysis of these crystals. The crystals from Zone I of the thick paper chromatography of the combined Cuts 111 and 112 were thus adequately identified as nystose.

[5] ALBON & GROSS: *Analyst*, 1952, **77**, 410.
[6] LEMIEUX & BAUER: *Anal. Chem.*, 1954, **26**, 920.
[7] GROSS: *Nature*, 1953, **172**, 908; 1954, **173**, 487; 1956, **178**, 29.

(E) *Isolation of Planteose.*—The residual syrup from Zone II of the thick paper chromatography of combined Cuts 111 and 112 reacted as follows: Molisch-positive; Benedict, before acid hydrolysis-negative, after acid hydrolysis-positive; invertase-negative; emulsin-positive (yielding substances with mobilities on paper identical to those for sucrose and

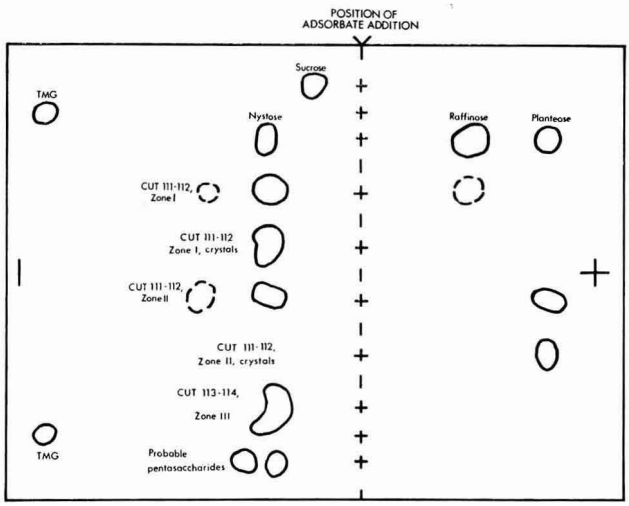


Fig. 3. T.M.G. = 2,3,4,6-tetra-*O*-methyl-α-D-glucose

galactose); acid hydrolysis produced substances with R_f values on paper identical to those for galactose, glucose and fructose. The $R_{sucrose}$ and $M_{sucrose}$ values on paper for this syrup were 0·33 and 1·90, respectively (Fig. 3), being identical to those for planteose. Seeding an aqueous methanol solution of 34 mg of the Zone II residual syrup at 25–27°C with planteose dihydrate yielded 8 mg of rectangular plates. The X-ray powder diffractogram of these crystals was identical to that for planteose dihydrate[8]. It can be considered that these crystals were properly identified as planteose dihydrate.

(F) *Probable Presence of Pentasaccharide(s).*—The Molisch and Benedict reagents confirmed the presence of non-reducing sugars in the residual syrup from Zone III of the thick paper chromatography of combined Cuts 111 and 114. The $R_{sucrose}$ and $M_{sucrose}$ values of this syrup were the same as those of the probable pentasaccharides obtained from the action of a fungal alpha amylase on sucrose (Figs. 1 and 3). The limited acid hydrolysis of the Zone III residual syrup yielded substances with R_f values on paper identical to those for nystose, 1-kestose, sucrose, glucose and fructose.

Discussion

Prior to the advent of modern chromatography only sucrose had been isolated in crystalline form from cane final molasses. The isolation of crystalline D-glucose[9] along with *myo*-inositol[9] and D-mannitol[9] was achieved with clay column chromatography[10]. When this technique was utilized in conjunction with sugar acetate chromatography[11], D-fructose (as its crystalline tetraacetate[9]) was then obtained. The presence of D-psicose[12] and D-mannose[12] was established with carbon[13] and clay column chromatography aided by high-voltage paper electrophoresis[7]. Chromatography on a four-metre clay column separated from cane final molasses two non-sucrose, oligosaccharide fractions[1]. The more mobile fraction was found to contain 1-kestose, 6-kestose, neo-kestose and an unidentified oligosaccharide; this mixture was resolved with a column of cellulose powder. The application of thick paper chromatography to the second fraction led to the first isolation of raffinose from a cane sugar product[1]. In the present work the continued application of this technique to this fraction has now afforded a second galactosylsucrose, planteose and a fructosyl-1-kestose, nystose, and revealed the probable presence of one or more pentasaccharides in cane final molasses. The minimum concentrations of planteose and nystose (based on the yield of crystalline material) were 0·004 and 0·017% respectively.

Summary

Planteose and a fructosyl-1-kestose, *nystose*, were isolated in crystalline form from cane final molasses; the respective minimum concentrations of these sugars were 0·004 and 0·017%.

Acknowledgment

A portion of this work was performed under a contract between the Sugar Research Foundation, Inc. and the Ohio State University Research Foundation (Professor M. L. Wolfrom, supervisor). Certain research samples from this contract were kindly made available by Professor Wolfrom. The assistance of Mr. E. J. Roberts, Sugarcane Investigations, United States Department of Agriculture, with the paper electrophoresis and of Mr. H. Chanzy, State University College of Forestry at Syracuse University with the X-ray diffractograms is gratefully acknowledged.

* * *

Sugar production in Yugoslavia, 1964.[14]—The area harvested in 1964 was 88,000 hectares, producing 2,830,000 metric tons of beet from which were obtained 321,381 metric tons of sugar.

[8] French *et al.*: *J. Amer. Chem. Soc.*, 1953, **75**, 709.
[9] Binkley & Wolfrom: *J. Amer. Chem. Soc.*, 1950, **72**, 4778.
[10] Lew *et al.*: *ibid.*, 1946, **68**, 1449.
[11] McNeely *et al.*: *ibid.*, 1945, **67**, 527.
[12] Binkley *et al.*: *I.S.J.*, 1963, **65**, 169.
[13] Whistler & Durso: *J. Amer. Chem. Soc.*, 1950, **72**, 677.
[14] F. O. Licht, *International Sugar Rpt.*, 1965, **97**, (7), 7.

THE INTEGRAL CATCH-ALL

By L. A. TROMP, A.M.I.Mech.E.

IN a previous article[1] the detached type of catch-all for evaporators and vacuum pans was described, demonstrating the basic concept of the innumerable designs in existence. A number of these can be incorporated within the vapour producing apparatus, but there are also several other designs specially made as integral catch-alls which are described below.

Umbrella type

The umbrella type, sometimes named after its inventor HECKMANN, is shown in Fig. 1; this has been applied in the past in quite a number of vacuum pans. Although the principle may be considered sound, stream-line flow can affect its efficiency and this may have led to its abandonment. The vapour flow is deflected through the umbrella and any droplets caught by it are thrown out of the vapour path against the inside periphery of the surrounding shell, owing to their greater inertia compared with that of the vapour molecules.

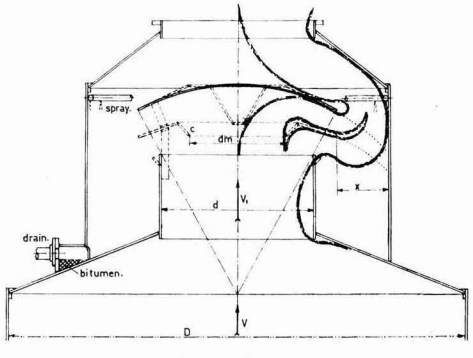


Fig. 1. Umbrella type

The approximate vapour current is shown by point-dotted lines; this bends sharply around the edge of the umbrella periphery. Because of the draught of the condenser the cavitation effect can be neglected, but the resistance to the vapour flow will depend upon the outlet passage of the umbrella. The vapour velocity at that passage should not exceed 60–75 m/sec (200–250 ft/sec).

The distance x between the umbrella and the shell should be made as large as possible for increased separating effect.

By arranging an intermediate deflector c, the vapour current will be split and the striking effect on the droplets will be improved.

The throat dm of this auxiliary deflector should have a diameter of 0·7d, where d is the vapour pipe diameter.

Although dished or domed deflector plates are preferable, welded cones of plate material can be used as a substitute.

When the vacuum pan is made of steel plate, the catch-all shell is welded to the cupola of the vacuum pan. In the case of cast iron, as formerly used in many instances, a flanged connexion is provided.

Drainage is obtained in most cases through a bent pipe inside the vapour space of the vacuum pan, but, as the flow of the drained liquid cannot be observed, an outside drain pipe with a sight glass is a better arrangement. The drainpipe must be connected to the vacuum pan body above the massecuite strike level and it will be obvious that the sight glass must be located in such a way that it can be observed from the operating platform.

The vapour velocity V_1 in the catch all neck will be considerably higher than V in the vapour space of the vacuum pan body according to the proportion $D^2 : d^2$.

It will now be evident that vapours are thus accelerated and, with too small a vapour space above the massecuite level, too much liquid may be drawn into the catch-all to be completely trapped.

Sufficient head room above the catch-all is required because the vapour outlet for this type will, of necessity, be on the top. Dead corners, where the separated liquid accumulates, can be appropriately filled with bitumen for preventing corrosion at these places.

Helmet type

In the Western hemisphere, this type has in the past found a large application and it may still be found on many a vacuum pan or evaporator. The design is shown in Fig. 2, the helmet being provided with a collecting ring r, often of copper.

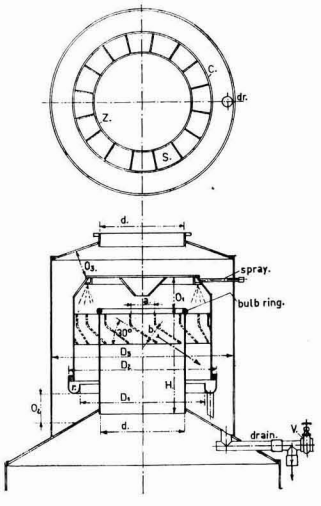


Fig. 2. Helmet type

[1] *I.S.J.*, 1964, **66**, 320–324.

For dimensioning, the following equations should be applied so as to avoid throttling:

$$(D_3)^2 - (D_2)^2 > (D_1)^2 - (d)^2 > d^2$$

A dished helmet is to be preferred to a flat or cone shaped one for better vapour guidance.

The distances O_1, O_2 and O_3 must be ample and, so as to improve the separating efficiency, deflecting vanes S can be arranged between the inlet throat Z and the helmet C. These vanes are welded to the outer periphery of Z only.

With a deflecting angle of 30° of these vanes, the proportion between entrance and outlet areas will be:

$$a : b = 2 : 1$$

and obviously the vapour velocity is accelerated to twice the entrance velocity. The whirl action will increase the separating effect through centrifugal force.

The drain pipe as shown in Fig. 2 is brought outside the catch-all and if the quantity of drained liquid is to be measured and analysed, a collecting vessel can be arranged with valves for disconnecting, vacuum breaking and discharge.

Clogging of the drain pipe is possible and a gate valve V will allow the horizontal stretch to be pierced by a steel rod.

The vapour discharge of the helmet type must, for good functioning of the catch-all, be on the top and sufficient headroom above for the vapour pipe elbow must be provided.

Vortex type

In several designs the cylindrical inner conduit, shown in Fig. 3, has been replaced by a cone sloping towards the top of the catch-all. From this inner conduit the vapour passes through a rectangular opening with an area of H × W into the vortex space around the former and leaves the apparatus through a lateral vapour pipe.

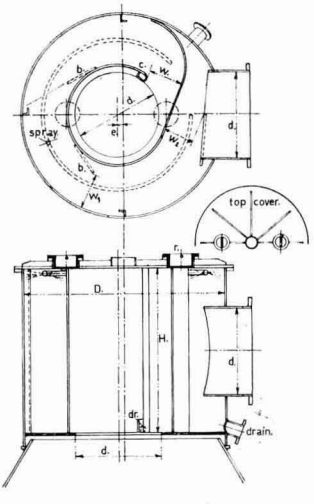


Fig. 3. Vortex type

Head room above the catch-all is required only for inspection and for bolting the cover plate.

So as to produce a venturi effect in the space around the inner conduit, the latter is displaced eccentrically by a distance e. which may amount to between 10–20% of the inlet and outlet diameters d.

To reduce the contraction, the corner of the passage W is rounded at c. While ascending through the inner conduit, vapour will be directed mostly towards the upper part of the H × W opening, which has induced designers to apply a conical inner conduit with a trapezoidal entrance port for the vortex space.

Nevertheless it is questionable whether this topmost flow of vapour will prejudice separation, because falling droplets are not so easily dragged along. By providing baffles b and proportioning the distances W, the vapour velocity can be increased and deflected. This applies especially when the inner conduit is located concentrically or with a small eccentricity e.

Angle irons welded on the inside periphery of the shell will collect the entrained liquid.

The passage W_2 should be about 0·33d and a larger eccentricity e will favour the length of the vortex space.

For the sake of easy inside inspection, two auxiliary covers r of small diameter are arranged in the top cover, which thus need not be lifted. A hot water spray under the top cover is a desirable addition. Normally the height H = 2d, but head room conditions may alter it and the shell diameter D may vary accordingly.

Inverted vortex type

This type, shown in Fig. 4, requires a relatively large shell diameter D_1, because the inner conduit of diameter D_2 must have an area twice that of the outlet pipe d.

Its characteristic consists in the inversion of the vortex flow, and droplets will thereby have less chance to enter into the vapour outlet; the centrifugal force at the turning point of the vortex undoubtedly will foster the separation.

The inner conduit with a diameter $D_1 \sim 1{\cdot}5d$ has a partition in the centre, the bottom of the left hand section being open for vapour entrance from below, whereas the right hand section is blocked.

A higher vapour velocity normally prevails through the entrance port W into the vortex than in the left hand inlet from below. On the other hand the outlet port W_1 is dimensioned more liberally so as to reduce the vapour velocity at the inward deflection towards the outlet pipe.

It will be obvious that the vortex width at R_1 is partially obstructed by the vapour outlet pipe and therefore the inner conduit must be placed eccentrically by distance e from the centre of the outside shell.

A venturi effect obtained in the vortex space, as previously mentioned, is of advantage for better separation of droplets with only a very slight fall in absolute vapour pressure.

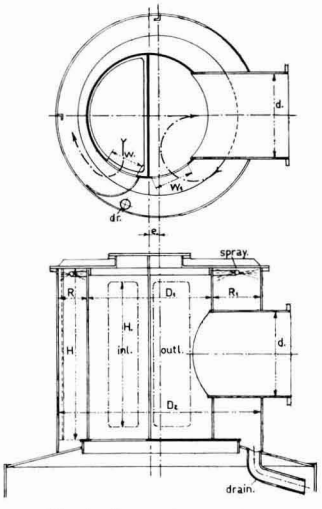


Fig. 4. Inverted vortex type

Because of the obstruction through the vapour outlet pipe, the height H_1 will be normally greater than 2d.

An open drain pipe is shown in Fig. 4; this discharges inside the vacuum pan or evaporator to which the catch-all is fitted. Since it is not open to inspection, this pipe must have an ample diameter, whereas the slope may be considered as non-clogging.

Centrifugal type

The centrifugal type of catch-all has found many applications, both detached and integral, and nowadays is frequently installed. The theory of its design has been dealt with previously[1] and Fig. 5 shows a design mounted on the cupola of a vacuum pan, with a lateral vapour outlet.

It should, of course, be stated that the centrifugal catch-all is in its most favourable form when the vapour outlet is on top. This condition cannot always be met, however, and the design of Fig. 5 shows the design with a lateral vapour outlet. For this purpose an intermediate cone with a slanting truncated cylindrical mouth is built inside the catch-all shell before the vapours take their lateral course.

Such an arrangement is not the ideal one, because the condenser draught will divert the vapour current already before leaving the interior slanting cone mouth. Also, the total height of the apparatus is increased. Quite a number of designers of catch-alls provide a shield or deflector plate U below the vapour entrance on the cupola of the vapour producing vessel. This shield has the purpose of avoiding stream-flow to the afore-mentioned vapour entrance by means of an annular inlet with a diameter d about 1·6 times the diameter of the vapour pipe and an opening h of 0·2d.

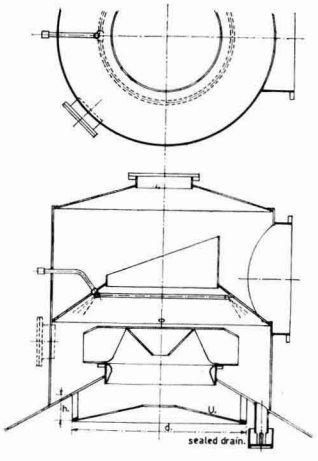


Fig. 5. Centrifugal type with lateral outlet

For the discharge of the entrained liquid a sealed drain inside the vacuum pan or evaporator is shown and a small bent tube for low pressure steam is recommended for cleaning the drain, especially on vacuum pans.

Demister type

During the last ten years a new device for entrainment prevention has been applied, consisting of a mat of wire gauze of corrosion-proof metal and having a thickness of about 6 inches.

Owing to the extremely large contact area there is a good "screening" of droplets; the accumulated liquid however must trickle out from the wire gauze mat.

By observation of a particular installation, illustrated in Fig. 6, it was found that a part of the demister mat was not penetrated by the vapour flow and, by evaporation of the entrained sugar-containing liquid, these ineffective areas of the wire gauze mat became clogged.

An efficient hot water spray above the demister is therefore an essential requirement to wash out any incrustations which may form.

All entrainment preventers cause a small resistance to the vapour flow; for the demister this is accepted as approximately 0·08 kg/sq.cm. ($\frac{1}{4}$ in Hg column), i.e. less than 1% of atmospheric pressure. The resistance depends upon the vapour velocity through the area of the gauze matting. The installation in Fig. 6 had a bell-bottom midway up the height of the vapour belt of the evaporator. This arrangement

apparently caused streamline flow of the vapour currents as could be deduced from the clogged areas A of the demister.

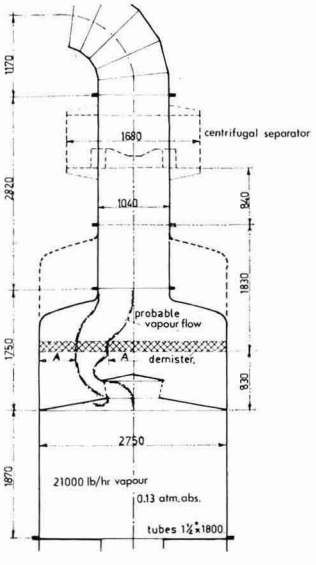


Fig. 6. Demister type

Moreover the demister was arranged close to the cupola of the evaporator, but increasing the vapour belt height by 900 mm (3 ft) did not show any improvement and a centrifugal separator has been arranged in the vertical vapour pipe on top of the evaporator, as indicated by dotted lines.

Raschig Demister type

Although of a much older date than the wire gauze demister, the Raschig system of entrainment prevention has not found general acceptance in either cane or beet sugar houses.

The system consists of a layer of glazed ceramic or metal rings on a false bottom in the upper part of the vapour belt of evaporators. Owing to the greatly increased contact area and the zig-zag passage through the layer of these rings, droplets are caught and will drip.

Adhesion of the liquor will be low on the glazed surface of the rings, but is it advisable to fit a hot water spray on top of the Raschig rings in order to remove any incrustation forming through evaporation of the liquid film.

Summary

Most catch-alls have certain advantages and disadvantages, not only as regards entrainment prevention itself, but also as regards facility of design and manufacture as well as available space.

Nowadays the centrifugal type is preferred by many designers, after having been neglected for many years.

The inverted vortex and whirl types should not be underestimated however. In all cases the possible occurrence of stream-line flow of the vapour should be considered, as the separated droplets may again be dragged along by the discharging vapour currents.

As there are no catch-alls with a 100% entrainment separation, the work imposed on them should not be aggravated, when this can be avoided. HAUSBRAND has indicated the safe vapour space volume for different absolute vapour pressures, which will reduce the danger of carry-over. Nevertheless the height of the vapour space above the boiling liquid is equally important.

For first and last evaporating bodies especially, a vapour belt above the calandria should have a height of $2\frac{1}{2}$ times the tube length, as now generally applied.

Current vacuum pans of some designers have a vapour space height equal to about 85% of the strike level above the calandria; this will certainly reduce the occurrence of boiling-over.

Correspondence

To the Editor, *The International Sugar Journal.*

Dear Sir,

RELATIVE DECOLORIZING POWER OF CAL CARBON AND BONE CHAR

My apologies to Mr. WITHERS[1]. When I described his figures as misleading, I meant only that they were quotations from an article by my friend DWIGHT GILLETTE, and that these figures, collected in 1957, have been outdated by advances in technology.

I agree with the reasoning in paragraph 3 of Mr. WITHERS' letter. We know that (British) bone char is a somewhat better adsorbent for carbonatated liquor only because we compared CAL carbon and bone char for long periods under similar conditions. With the same liquor transit time and on a 24-hr "start", the volumetric capacity of a decolorizing plant is for practical purposes independent of the adsorbent used.

It is agreed that the "burn" of bone char will, by weight, be about 10 times the weight of CAL carbon. A regenerating kiln is, to a great extent, an evaporator, and so the fuel usage will very not in proportion to weight, but only by a factor of 3–5.

Mr. WITHERS' kiln, burning 700 lb/hr of CAL carbon, would burn at least 1500 lb/hr of bone char, and this is enough char for 300 tons of (raw) sugar per day.

Yours faithfully,

F. M. CHAPMAN,
Technical Adviser,
Tate & Lyle Refineries Ltd.

[1] *I.S.J.*, 1965, **67**, 179.

Arrestor halts fly-ash threat. ANON. *Sugar y Azúcar*, 1964, **59,** (11), 74.—With increased cane crushing, the management at Lihue was faced with the problem of dumping the bagasse or of burning it and coping with additional fly-ash which was already a difficult problem. An arrestor was fitted in the 1963/64 off-season and has controlled fly-ash, so resolving the dilemma.

* * *

Micro-organism control in cane sugar mills by organic sulphur compounds. A. APPLING. *Proc. 11th Ann. Conv. Philippines Sugar Tech.*, 1963, 86–104.—Advantages of "Busan 881"[1] as a cane mill disinfectant and inactivator for invertase are described as are the techniques for its application and assessment of its effects. An example from Peru is quoted.

* * *

Steam turbines for the sugar industry—their selection, application and designs. A. A. HAMBOURIS. *Proc. 11th Ann. Conv. Philippines Sugar Tech.*, 1963, 105–127.—The paper is divided into two parts, the first discussing application and selection criteria for mill turbines in respect of h.p. rating, gearing, speed, single *vs.* multi-stage, and individual or combined drives. Design criteria employed by the Worthington Corporation are indicated in the second part, with an illustrated account of the features of their turbines.

* * *

The diffusion process applied to sugar cane. J. L. CUENCO. *Proc. 11th Ann. Conv. Philippines Sugar Tech.* 1963, 128–131.—The concept of cane diffusion is discussed and advantages compared with milling are listed. Combined milling and diffusion is described and comparative cost estimates for 5000 tons/day diffuser and milling installations reprinted[2].

* * *

An improved process of evaporating sugar liquors. F. A. MAPA. *Proc. 11th Ann. Conv. Philippines Sugar Tech.*, 1963, 247–253.—The paper reads like a patent application for a method of reducing the overall time necessary to evaporate clear juice to syrup and to convert this to massecuite in a vacuum pan. The effect is achieved by operating all the effects under vacuum and removing the excess steam produced in each effect by by-passing through an equalizing tube of adequate diameter connecting the vacuum space of all effects which are thereby all connected to the barometric condenser, valves being provided at each of the junctions so as to maintain appropriate vacuum levels in each effect (e.g. more than 2 in Hg in the 1st, 12–14 in the 2nd and 27–28 inches in the 3rd effect of a triple-effect evaporator).

Some experiences in E.P. (extreme pressure) lubricants in the centralized lubrication systems of sugar mills. C. S. MASICLAT. *Proc. 11th Ann. Conv. Philippines Sugar Tech.*, 1963, 254–257.—Difficulties in mill journal lubrication are discussed as are the advantages of centralized lubrication systems. Lubricant criteria are reviewed and it is indicated that E.P. lubricants are more effective than conventional lubricants while operating costs compare favourably.

* * *

Boiler feed water treatment with "Lewatit CNO" ion exchanger. J. L. CUENCO and M. A. OCHAVILLO. *Proc. 11th Ann. Conv. Philippines Sugar Tech.*, 1963, 346–355.—An account is given of the treatment of artesian well water with "Lewatit CNO" cation exchange resin and regeneration of the latter.

* * *

Sugar central expansion. T. O. SORIANO. *Proc. 11th Ann. Conv. Philippines Sugar Tech.*, 1963, 356–359. A list of 20 items to be considered in respect of sugar factory expansion are briefly discussed. They include water availability, transportation, communications, etc.

* * *

Evaluation of the tremendous losses in milling cane trash. T. B. ANCHETA. *Sugar News*, 1964, **40,** 522–532, 567.—The literature on the effects of trash in cane milled is surveyed, with 18 references. Tables are presented of the relationship between trash of varying fibre % cane, and of the effect of trash on bagasse % cane, sucrose % cane, sucrose extraction, on overall factory recovery, and on total losses. The economic effects are calculated and their importance shown to indicate the necessity of minimizing trash in cane entering the factory.

* * *

Some further notes on crystallizer performance. Cooling and reheating of massecuites. J. C. CHOU. *Taiwan Sugar Quarterly*, 1964, **11,** (3), 9–13.—Comparison was made between the cooling of equal parts of the same massecuite in air-cooled and water-cooled crystallizers. After 30 hr, the massecuite, originally at 60–64°C, was reduced to 45°C and 35°C, respectively. The purity dropped on average by 0·31 units with air-cooling and by 8·15 units with water-cooling. The supersaturation coefficient falls at first but then increases, this increase being greater with water-cooling since the viscosity rises to the extent

[1] *See also I.S.J.*, 1959, **61,** 86; 1960, **62,** 222; 1963, **65,** 179; 1964, **66,** 157.

[2] From SCHAFFER & HUCKEBA: *Sugar J.* (La.), 1962, **25,** (6), 8–18; *I.S.J.*, 1963, **65,** 178.

that deposition cannot keep pace with decrease in sucrose solubility due to lower temperature. The water-cooled massecuite also requires a longer purging time (14 min *vs.* 10 min), and gives a lower purity. By re-heating to the same temperature as reached with air-cooling, the purging time is virtually the same and sugar purity is somewhat better, while the higher crystal content results in a lower molasses purity, since there is no appreciable redissolving of crystals.

* * *

Sugar refining. H. S. WU. *Taiwan Sugar Quarterly*, 1964, **11**, (3), 29–31.—An account is given of the simplified refining system which was started at Pingtung sugar factory in 1964. The raw sugar is affined, raising its purity from 96·86 to 99·29%, and is then melted to 60°Bx, carbonatated and filtered, followed by decolorization by filtration through granular carbon. The liquor is boiled to give 4 crops plus a recovery crop and a brown sugar crop.

* * *

An investigation into the performance of a BMA centrifugal at Gin Gin. 1963 season. ANON. *Queensland Bur. Sugar Expt. Sta. Operations Rpt.*, 1964, (1), 11 pp. + 2 figs., 1 p. photomicrographs and 3 tables; through *S.I.A.*, 1964, **26**, Abs. 838.—Comparative tests on low-grade massecuites with a BMA type K-1000 continuous centrifugal and two ASEA 48 × 30 in batch centrifugals are reported. Massecuite throughputs and "C" sugar purities were raised significantly by operating continuously (when using $>\sim 2\%$ wash water) but final molasses purities increased by ~0·5 units. Heating the massecuite before continuous centrifuging by passing it through a resistance heater[1] increased throughput by ~ 0·7 ton/hr for a 6°C rise, and decreased final molasses purity by ~ 0·6 units, but the sugar purity also decreased by 2–11 units depending on the wash water level. Dilution with ~ 20% of final molasses followed by heating appeared to give a greater throughput of "C" sugar than did heating alone. The BMA machine caused little or no grain fracture (10% maximum) and consumed about half as much power as the batch machine. The possibility of double purging with continuous machines is briefly discussed.

* * *

Rationalization of the technological process of refining raw sugar. D. M. LEIBOVICH and I. F. ZELIKMAN. *Izv. Vysshikh Ucheb. Zaved., Pishch. Tekhnol.*, 1964, (3), 80–86; through *S.I.A.*, 1964, **26**, Abs. 854.—The purification of melter liquor and of affination syrup was investigated. Affined raw sugar liquor was defecated with 1·5% of CaO (on solids) and sulphitated. The liquor was then decolorized in a column of AV-16G anion exchange resin in the OH^- or Cl^- form. The regeneration of the resin with 2% NaOH at 80°C followed by washing with water and activation with 0·1N HCl at 20°C resulted in a nearly neutral pH of the decolorized liquor. The decolorizing capacity of the resin was ~ 2 times as great at the liquor flow rate of 1 bed volume/hr as at 3 bed volumes /hr. High quality first and second sugars were crystallized from the treated liquor. The affination syrup was clarified by carbonatation, preferably with 3% CaO and a final pH of 9·0, to give a minimum content of colloidal matter (0·5%) in the filtrate. The clarified liquor was then purified by electrodialysis at 30°Brix and 50°C in a 5-chambered apparatus. The electrodialysis was carried out in two stages with intermediate neutralization of the liquor with AV-16G (OH^- form) to prevent the pH from falling below 5·9. Each stage was carried out in four phases with a decreasing current of 6, 5, 4 and 3 mA/sq.cm. respectively. The two-stage processes removed a total of 60% of the electrolytes, 37% of the non-sugar, 39% of N and 60% of the colour, giving an electrodialysed liquor of 96 purity.

* * *

Meinecke chutes. D. H. C. DUBOULAY. *J.A.S.T.J.*, 1962, **24**, 40–45; through *S.I.A.*, 1964, **26**, Abs. 913.—The design and performance of Meinecke inter-mill chutes, which have no moving parts, are discussed and compared with those of intermediate carrier systems. The development of a modified Meinecke chute, which avoids breakage of the bagasse blanket by its reduced curvature, is reported and discussed with detailed diagrams.

* * *

Bagasse incinerator. F. S. ALLWOOD. *J.A.S.T.J.*, 1962, **24**, 47–50; through *S.I.A.*, 1964, **26**, Abs. 923. A furnace for the destruction of surplus bagasse is described and operating experiences are reported. The maximum capacity is only 1½ tons/hr owing to difficulties in cooling the waste gases to a safe level.

* * *

Development of (Mauritius) sugar factories. L. LINCOLN. *Rev. Agric. Sucr.* (Mauritius), 1964, **43**, 242–250.—Changes that have occurred in factory equipment and practices in Mauritius during the period 1948–1963 are surveyed.

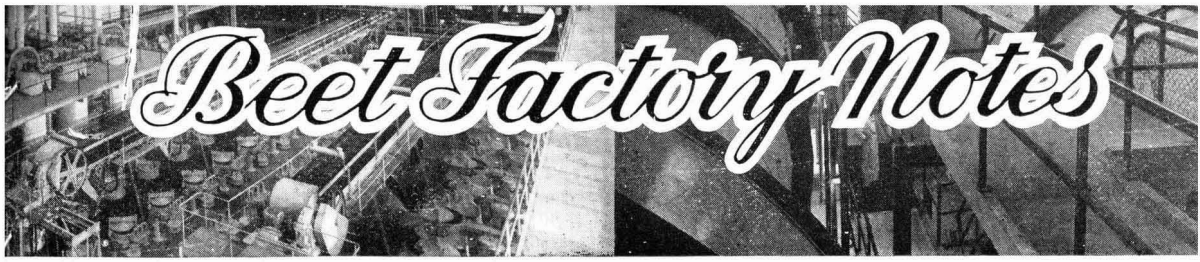
* * *

Development of the Réunion sugar industry in the last ten years. E. HUGOT. *Rev. Agric. Sucr.* (Mauritius), 1964, **43**, 258–264.—A brief account is given of changes in cane varieties, and of factory equipment and practices since 1954 in Réunion.

* * *

Development of research in sugar technology and observations on chemical control. J. DUPONT DE R. DE ST. ANTOINE. *Rev. Agric. Sucr.* (Mauritius), 1964, **43**, 288–303.—Development of the research staff concerned with sugar technology at the M.S.I.R.I. is described and an account given of the problems studied since its initiation in 1956, together with a number of observations on chemical control, and in particular weighing and refractometric Brix measurement.

[1] WRIGHT: *I.S.J.*, 1964, **66**, 394.



Chemical cleaning of technological equipment. E. A. KHODURSKII, V. YA. BOGUN and G. D. SKORIK. *Sakhar. Prom.*, 1964, **38,** 896–897.—At Buzhanskii factory, equipment is descaled by passing 5–10% caustic soda solution at 60–70°C through pipelines linking all the sections up to and including the evaporator in a closed circuit. After 3 days' treatment, the equipment and pipelines have been cleaned to the metal. Calculations of the amount of lime and soda ash are given as well as a brief note on the monetary savings effected.

* * *

The construction of certain auxiliary equipment. P. S. MAKSIMUK. *Sakhar. Prom.*, 1964, **38,** 898–901. Advice is given on the construction of grids and chutes at the beet end of a sugar factory, particularly regarding the angles of slope and lengths. The recommendations are exemplified by data from a number of Soviet factories.

* * *

Collecting impurities from flume-wash waters and sorting them. M. A. KRASNOKUTSKII. *Sakhar. Prom.*, 1964, **38,** 904–906.—At Kamenets-Podol'skii sugar factory impurities in flume water are transported with some water from the beet washer down a chute to a rake conveyor, and then pass on this over a grid through which the water drains to a collector. The rest of the water from the washer is separated when the beet pass over a roller grid after the washer. The water then passes down a pipe and is discharged above the rake conveyor where this passes over the grid. The impurities are then carried up a sloping section of the rake conveyor and at the top fall via a chute to an extension of the belt conveyor carrying pressed pulp to the dump. Beet tails and crowns tend not to stay on the conveyor belt but after falling from the chute bounce into a hopper to the side of the conveyor and thence pass to the flume. Modifications to the beet washer are also described. The equipment for water and impurities separation has operated satisfactorily for 100 days, and the labour force has been reduced from 9 to 3 men.

* * *

New sugar factory with a daily slice of 50,000 zentners (5000 metric tons) of beet. N. M. VALUEV and E. KH. BERKOVICH. *Sakhar. Prom.*, 1964, **38,** 907–912. Information is given on the general layout and structural features of the new factory at Timashevskii, the equipment for which (except the Steffen plant, which is of Soviet origin) was supplied by Braunschweigische Maschinenbauanstalt A.G. who also planned the layout of the technological and heating and power plant sections. The bulk storage silos for white sugar were supplied by Lucks & Co. and equipment for hydraulic unloading of beet from rail trucks (constituting 20% of the total delivery) was supplied by Elfa-Apparate-Vertriebs G.m.b.H. The main factory building is in the form of an H, with the two parallel wings joined by an overhead gallery housing the laboratory and main control panel.

* * *

Timashevskii sugar factory in operation. I. V. POLESHKO and A. A. SOLLOGUB. *Sakhar. Prom.*, 1964, **38,** 912–922.—Further details are given of the factory referred to in the previous abstract. The two BMA tower diffusers are fully automatic and operate on remote control. A full description is given of the BMA carbonatation scheme which includes defeco-saturation in three vessels followed by settling and 2nd carbonatation. The filter station includes vacuum filters, Schumacher and Stellar candle filters. The treated juice is de-limed and decolorized by ion exchange before evaporation in the quadruple-effect evaporator. Two massecuites are boiled, the pans being heated with 2nd and 3rd evaporator effect vapour. Fully-automatic centrifugals are used for 1st and affination products, while conical machines are used for low-grade massecuite. Preliminary results from the 1963/64 campaign are discussed. The sugar loss up to molasses averaged 1·12% on weight of beet, molasses yield averaged 6·30% on weight of beet, molasses sugar content averaged 3·24% on weight of beet and yield of sugar averaged 11·75% on weight of beet at an average colour of 1·0°St. Some defects in operation are noted and a list of recommended remedies is given.

* * *

Continuous crystallization and crystallization by cooling. A. ACCINELLI. *Ind. Sacc. Ital.*, 1964, **57,** 183–197.—The classic boiling process is discussed and the importance of the crystallizer work in obtaining crystalline sugar as compared with pan work is emphasized. By intermediate cooling of massecuites it is possible to raise their crystal content, thereby reducing the amount of boiling needed. Three such schemes are presented, with details of quantities, Brix values, etc. They reduce massecuite quantities by 19·9, 20·5 and 25·1% and boiling time by 26·3%, 26·3% and 52·6%.

* * *

Technological value of sugar beet. S. TARČINSKI. *Prehranbena Ind. Jugoslav.*, 1963, **8,** 159–161; through *S.I.A.*, 1964, **26,** Abs. 841.—Methods for estimating the yield of sugar from beet are briefly reviewed. The method used at Péc factory is described, based on the beet digestion D, purity Q of thin juice purified

in the laboratory, and the mean purity q of molasses over a 10-day period. The average sugar losses during extraction and purification (0·654% on beet for Jugoslavia) are subtracted from the digestion in the calculation of thin juice non-sugar % beet. The molasses sugar (% on beet) is given by $M = (D - 0{\cdot}654)\ (100 - Q)\ q/Q(100 - q)$, and the white sugar yield is therefore $D - (0{\cdot}654 + M)$. A typical estimate of white sugar production was 3% (on sugar) less than the amount produced.

* * *

Extraction of sugar from beet. III. Extraction of sugar from dried cossettes. T. SIMIZU, H. KOZIMA and S. KISIHARA. *Sci. Rpts. Hyogo Univ. Agric.*, 1962, **5,** 129–134; through *S.I.A.*, 1964, **26,** Abs. 842. The dried cossettes[1] were extracted by four different means: hot water at 75°C, cold water at 27°C with ultrasonic waves (400 kc/s), cold water at 20°C, and 90% ethanol at 78·5°C. The equilibrium sucrose concentrations were reached after 40, 90, 180 and 300 min, respectively. Although the 90% ethanol extracted a smaller amount of ash and pectin, a significant amount of sucrose was inverted during the extraction, presumably by the effect of temperature and time.

* * *

Normalizing the consumption of water in the washing of sugar in first product centrifugals. L. S. TVERDOKHLEBOV and D. V. GORBAN'. *Trudy Grupp. Lab.*, 1959, 65–71; through *S.I.A.*, 1964, **26,** Abs. 851.—The production of white sugar by washing raw sugar in the centrifugal with water is discussed. It is recommended to instal a flow meter in the water main supplying the centrifugals to measure the mean water consumption (in the range 2·5–7% on massecuite), and to construct curves showing the exponential decline in sugar colour and linear fall in sugar yield with increasing water consumption. In this way the amount of washing to obtain sugar of a given colour can be controlled and sugar losses can be reduced.

* * *

Complex mechanization of limestone preparation. V. P. BIBIK. *Sakhar. Prom.*, 1964, **38,** 923–925.—A limestone crushing and sorting unit (the SM 9/10) is described. It crushes 40 tons/hr of limestone and needs only 2 operators. The stone is tipped from a lorry into a hopper which feeds it at a uniform rate to the crusher, whence it passes over a vibratory sieve. Waste chippings, etc., fall through the sieve.

* * *

Variation in the composition of final molasses from the "October" sugar factory in the 1950-51 campaign. L. S. TVERDOKHLEBOV and O. S. CHIBISOVA. *Trudy Grupp. Lab.*, 1959, 112–121; through *S.I.A.*, 1964, **26,** Abs. 861.—Analyses were carried out on monthly samples taken from September to January from a factory characterized by high molasses yields. The results are expressed as kg of the various classes of non-sugar per 10,000 kg of beet. Sugar losses increased during the period from 2·43% to 2·85% on beet. The amount of total nitrogen, reducing substances, lime salts and organic non-sugar increased during the period, and the alkalinity decreased. The amount of carbonate ash was nearly constant, reaching a minimum in November and December. The variation is ascribed mainly to the degradation of reducing substances and to increased inversion due to recirculation of products.

* * *

Improvement of the method of determining the standard purity of final molasses. L. S. TVERDOKHLEBOV and O. S. CHIBISOVA. *Trudy Grupp. Lab.*, 1959, 83–99; through *S.I.A.*, 1964, **26,** Abs. 862.—The conditions for the exhaustion of molasses to standard purity (corresponding to saturation at 40°C and 83·5°Brix measured by 1:1 dilution) were investigated with particular regard to molasses of high initial purity. The degree of supersaturation of the exhausted molasses was determined after allowing for the saturation coefficient of sucrose, calculated from the non-sugar:water ratio by an empirical equation[2]. The results are reported in detail. The following conditions are recommended: the addition of 40% of crystal to the artificial massecuite which should contain $\lessdot$ 150 g of molasses and 100 g of sugar; crystal size 0·25–0·50 mm; free space of $\lessdot$ 2–3 cm above the massecuite; preliminary concentration of molasses of 60 purity to 84·5°Brix, 65 purity to 85·5–86·0°Brix, and 70 purity to 87·0–87·5°Brix, to allow for the Brix change in crystallization; crystallization time of 3–4 days, according to the initial purity.

* * *

Improving the heat transfer in evaporators by subdividing the heating surface. G. WEIDENFELD. *Zucker*, 1964, **17,** 680–686.—By sub-dividing the heating surface, e.g. into six sections, the effective temperature difference can be increased and the heat transfer from tube to liquid raised. In the example quoted of a third effect in a quintuple-effect evaporator, a saving of 36·66% in heating surface is possible.

* * *

Technological equipment installed in Serrae sugar factory in Greece. E. MALANOWSKI. *Gaz. Cukr.*, 1964, **72,** 257–259.—Descriptions are given of a liming tank with a submerged mixing device and means of reducing the juice retention time, and equipment for sulphur burning.

* * *

Theoretical study of compartmented continuous diffusers. G. GENIE. *Sucr. Belge*, 1964, **84,** 97–113, 153–162. Sucrose diffusion from beet cossettes is considered theoretically and the equations developed extended to beet diffusers in general and the RT diffuser in particular, with examples of calculations applied to practical problems.

[1] See *I.S.J.*, 1962, **64,** 19.

[2] KAGANOV & TVERDOKHLEBOV: *Sakhar. Prom.*, 1956, (3), 53–54.

The effect of mud in clarified juice on the quality of 2nd carbonatation juice. M. KH. LIKHITSKII, I. M. LITVAK and L. P. REVA. *Sakhar. Prom.*, 1965, **39**, 26–29.—Laboratory tests on 1st carbonatation juice showed that the addition of raw juice (7% by volume) before settling reduced the amount of mud in the supernatant, although did not completely eliminate it. It had no adverse effect on 2nd carbonatation juice, although the alkalinity of 1st carbonatation juice should be slightly raised so that the final pH of the mixed juice is 11. Increase in the amount of mud in the supernatant was found to increase juice colour and lime salts content and to reduce juice purity, even a small amount of 0·151% by volume raising the colour by almost 20% and the lime salts content by approx. 15%, compared with the filtered control. The deleterious effect is attributed to the fact that with a fall in pH to 9·2 in 2nd carbonatation, many of the non-sugars pass into solution. Reference is made to the work of other authors on this subject.

* * *

The corrosive properties of sodium triphosphate. A. K. KARTASHOV and A. D. GOLUBEVA. *Sakhar. Prom.*, 1965, **39**, 29–31.—In answer to ZABOLEV, who in his article[1] mentioned the harmful effect of sodium triphosphate on carbon steel, it is pointed out that when it is added to the 2nd carbonatation vessel, the PO_4— ions are almost completely precipitated as $Ca_3(PO_4)_2$, and only when 50–70% equivalent of triphosphate is added to the juice do any phosphate ions remain unprecipitated. Sulphitation of the juice to pH 7·8–8·0 before evaporation is recommended to stabilize juice alkalinity.

* * *

Drying and cooling granulated sugar in a fluidized bed. G. V. ERESHCHENKO. *Sakhar. Prom.*, 1965, **39**, 32–38. Tests with a laboratory-scale cylindrical unit showed that optimum conditions for fluidization were: air flow of 0·5 m/sec, bed height of 290 mm, and a moisture content below 0·3–0·25%. When drying a 100-mm bed of sugar, moistening of the upper layer was observed in the initial stages. Even under optimum conditions, the bed could be divided into two zones: an upper "boiling" zone in the form of a truncated cone, and a lower "dead" zone where the crystals remained stationary. During tests with a laboratory-scale experimental continuous dryer in which the sugar was moved along a horizontal screen by vibrations, vigorous mixing occurred, both horizontally and vertically, thereby considerably reducing the drying time. No lumping occurred, no crystals stuck to the walls or blocked the screen, and there was no attrition of the crystals. Cooling of dry sugar took place slowly in the cylinder, but in the continuous apparatus cooling from 67 to 32°C required only 1 min. However, it is still considered an inefficient process and the air consumption is high. Cooling of damp sugar in the continuous dryer was so intensive that the sugar was cooled to a temperature 10–12°C lower than the temperature of the cooling air. Reduction of the temperature from 64 to 27°C required only 48 min, during which the moisture was reduced from 1·23 to 0·15% at a drying air temperature of 25·5°C. At a drying air temperature of 43°C, the final moisture content was 0·08% and the temperature of the sugar was reduced from 63°C to 31°C. Combined cooling and drying required a total of 0·45 min to reduce the moisture content from 1·7% to 0·15% and the sugar temperature from 66 to 26°C.

* * *

Experience of Ryzhavskii sugar factory in increasing sugar yield. A. YA. D'YACHENKO. *Sakhar. Prom.*, 1965, **39**, 13–15.—By adopting certain measures in beet storage, slicing, diffusion, etc., which are described in detail, the factory increased its sugar yield from 14·95% in 1962/63 to 17·43% on weight of beet in 1963/64, reduced sugar losses from 0·96 to 0·86% and molasses sugar content from 2·38 to 2·31%, increased daily throughput and reduced production costs. Total number of stoppages was 0·28 days, i.e. 0·24% of the whole campaign.

* * *

Exchange of knowledge on the magnesium chloride process. G. QUENTIN. *Zeitsch. Zuckerind.*, 1964, **89**, 683–685.—A meeting of some 30 representatives from German and Austrian sugar factories was held at Salzdetfurth A.G., Hannover, to discuss various aspects of the magnesium chloride ion exchange process of molasses exhaustion. The points raised are discussed and a summary is given of the results obtained at the factories. It has been found that a maximum of 0·5% additional sugar on beet is obtainable and that the molasses is not adversely affected as regards subsequent yeast production. Other advantages, apart from the economics (these depend on the sugar:molasses price ratio, etc.), include: higher purity low-grade sugar and a reduction in the amounts of non-sugars recycled. The questions of regeneration waste water and of resin efficiency are also discussed.

* * *

New method of automatic cleaning of high-speed preheaters. K. H. SCHÖNBURG. *Zeitsch. Zuckerind.*, 1964, **89**, 685–686.—A patented process and unit are described in which quartz sand is fed from the separator, through which heated raw juice passes to carbonatation, via a sluice into the main juice stream which carries it into the pre-heater and thereby ensures mechanical cleaning of the tubes. The system incorporates a means of stopping quartz sand feed if the juice flow rate falls below a certain minimum, since otherwise the sand would block the tubes. A filler device is located between the point at which the sand joins the juice line and the heater to make up for any sand loss. The system has kept the heater tubes completely free of deposit at Friedberg sugar factory throughout a whole campaign, whereas formerly they had to be cleaned manually every 5 days.

[1] *I.S.J.*, 1964, **66**, 363.

NEW BOOKS AND BULLETINS

The Australian Sugar Year Book. Vol. 24, 1965. 432 pp.; $7\frac{1}{4} \times 10$ in. (The Strand Press Pty. Ltd., 236 Elizabeth Street, Brisbane, Queensland, Australia.) 1965. Price: £A1 10s.

Officially endorsed by The Queensland Cane Growers' Association and The Australian Sugar Producers' Association, the Year Book is the only publication giving an overall picture of the Australian sugar industry, which it does very well. It is divided into four main sections: a Sugar Industry Directory, which includes information on the various organizations concerned with the industry, with names of officers and staff, and addresses of the sugar factories; a collection of articles and reports, mainly concerned with the agricultural aspects of sugar production but also including summaries of papers presented at the 1964 Conference of the Queensland Society of Sugar Cane Technologists; Sugar Statistics, giving data on cane and sugar production in Queensland up to 1964; and a section on the Australian mills and districts, which gives a wealth of information on each mill (location, production level, mill plant, senior staff, etc.) and on the towns and cities and tourist attractions. An index to advertisers and contents is included.

* * *

Le Sucre (Sugar). F. CHARNY. 126 pp.; $4\frac{1}{2} \times 7$ in. (Presses Universitaires de France, 108 Boulevard Saint-Germain, Paris.) 1965.

This is a small paper-backed book, No. 417 in the series "Que sais-je" (What do I know?) obviously intended for the general reader who knows nothing or next to nothing about sugar. The subject is set out in a clear, concise manner, and chapters deal with the history of sugar, the cultivation of beet and cane, the mechanics of sugar production (cane sugar manufacture is hardly mentioned), properties and uses of sugar, consumption, the importance of sugar in the world, characteristics of the sugar industry and trade, and prices, some sections being in greater detail than others. An alphabetical list of countries is given, showing the extent of the sugar-producing season, type of plant (cane or beet), annual production, per caput consumption, and whether the country imports or exports sugar or neither. A very brief bibliography is also presented.

* * *

Sveklosakharnoe Proizvodstvo Ukrainskoi SSR (Beet Sugar Production in the Ukraine). M. M. PALAMARCHUK. 214 pp.; 5×8 in. (Akademiya Nauk Ukrainskoi SSR, Kiev.) 1964.

As the title indicates, this book is concerned with the Ukrainian sugar industry, from which comes 60% of the total amount of sugar produced in the Soviet Union. The history of the growth of the Ukrainian industry is outlined and the present-day situation appraised in tables as well as text. Modern features, sizes, throughput and location of factories are considered as well as the problems of labour requirements and campaign length. Here the author points out the essential differences between the length of campaign in "most capitalist countries" (he quotes a figure of 60–80 days) and the average campaign of 130–140 days in the Ukraine. Future prospects for the Ukrainian industry are discussed. The numerous tables are mainly of limited interest, although some quite useful data are given showing the average and total beet yields and factory outputs. Comparison of the rate of growth of sugar production in the Soviet Union and the U.S.A. as a percentage of the 1913 and 1917 figures (given as 100 for each country) is meaningless. Because of the language barrier the book will have a limited readership, but for some outside the USSR it does provide quite useful information on one of the most important sugar-producing areas in the world.

* * *

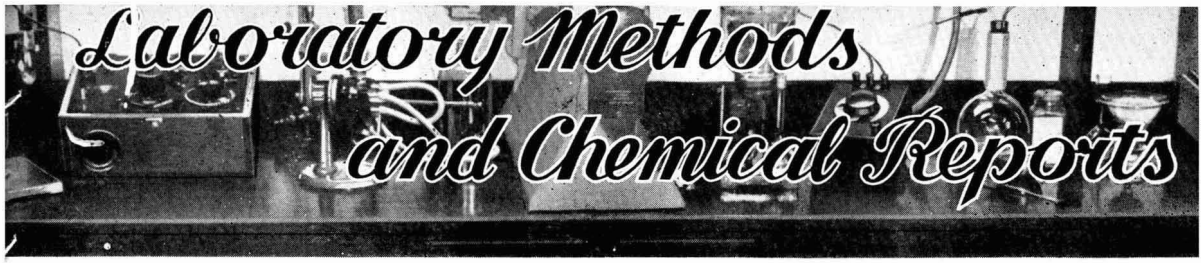
FAO Commodity Review, 1965. 175 pp.; $8\frac{1}{2} \times 11$ in. (Food & Agriculture Organization of the United Nations, Rome, Italy.) 1965. Price: 10s 0d.

This publication is one of a regular series of annual commodity reviews prepared by the Commodities Division of FAO's Department of Economic and Social Affairs. Part I contains a general review of developments in international commodity markets during 1964 and the early months of 1965 and also includes sections on regional economic integration arrangements and on international agreements and consultations. Part II consists of a series of chapters analysing the current situation and outlook for all the major agricultural commodities. In most cases the annual data on exports and imports relate to calendar years. The Review is generally based on information available up to 1st March 1965. The section on sugar notes the almost continuous decline in the world market price and the record production in 1964/65 of an estimated 61·4 million tons of sugar, i.e. an increase of over 7 million tons on the 1963/64 harvest. Expansion in world sugar consumption since 1962 has been only just over 1% per annum and in some countries consumption has even fallen. The U.S. sugar programme for 1965, the Commonwealth Sugar Agreement revision of 1964, and the proposed EEC sugar policy are discussed in some detail.

* * *

Trinidad and Tobago. 39 pp.; 6×8 in. (Barclays Bank D.C.O., 54 Lombard St., London E.C.3.) 1965.

This is a short economic survey of the territory and is one of a series of booklets published by Barclays Bank D.C.O. on the territories in which it operates. The information on sugar and bagasse is brief but adequate and the booklet gives a clear overall picture of Trinidad's economy and industry.



Clarification of solutions and removal of interfering substances in determination of reducing sugars. T. E. FRIEDEMANN, C. W. WEBER and N. F. WITT. *Anal. Biochem.*, 1963, **6,** 504–511; through *S.I.A.*, 1964, **26,** Abs. 889.—Several substances including cane molasses were clarified by adding a reagent containing 10% $HgSO_4$ and 10% $ZnSO_4$ in 1N H_2SO_4 and bringing to pH 7–8 with 1N NaOH. The samples were then filtered and Hg was removed by adding H_2S solution. H_2S was removed by aeration and addition of $PbSO_4$. The samples were again filtered and analysed. Colour removal was 70–99%. All amino acids except proline and hydroxyproline were removed almost completely. Percentages of other substances removed are tabulated. Glucose and fructose were completely recovered from the samples.

* * *

Specific gravity of water-alcohol-sugar solutions. S. E. KHARIN and A. A. KNIGA. *Izv. Vysshikh Ucheb. Zaved., Pishch. Tekhnol.*, 1964, (3), 60–65; through *S.I.A.*, 1964, **26,** Abs. 896.—A theoretical equation for the density d_p (g/c.c.) of aqueous sucrose solutions is derived:

$$\frac{d_p - d_o}{d_p} = \left[\left(1 - \frac{d_o}{d_2}\right) + \left(1 - \frac{d_o}{d_1}\right)\alpha\right] C,$$

where C = sucrose concentration (g/g of solution), d_0 = density of water, α = degree of hydration of sucrose (g of water per g of sucrose), d_1 = density of hydration water, and d_2 = density of dispersed sucrose. The three latter quantities are given by $\alpha = 0{\cdot}4484 - 0{\cdot}3842C$, $d_1 = 1{\cdot}068 + 0{\cdot}025\ C$, and $d_2 = 1{\cdot}5752 - 0{\cdot}00112\ t$, at t°C. The calculated values agree with the experimental values in the range 5–50% sucrose and 0–50°C to within 0·001 units and generally to within 0·0001 units. Similar calculations are made for sugar solutions in aqueous ethanol.

* * *

Sugar industry research laboratories in France. H. ZAORSKA. *Gaz. Cukr.*, 1964, **72,** 253–256.—A description is given of the laboratory of the Syndicat National des Fabricants de Sucre in Paris and information is given on the more important work carried out under its director, Prof. J. DUBOURG, during recent years.

* * *

Evaluation of the heterogeneity of sugar crystal size. A. L. SOKOLOVA and B. N. TERESHIN. *Sakhar. Prom.*, 1965, **39,** 19–21.—While sieve analysis is not feasible with non-free-flowing products such as massecuite, brown sugar and damp white sugar, the degree of heterogeneity of the crystalline mass can be determined by the method of variation statistics. A small sample of the test material (1–5 g) is diluted with sucrose-saturated glycerine and placed on the slide of a microscope. This is then photomicrographed or the contours of each crystal outlined. The mean arithmetical length of the crystals is given by the formula $M = \frac{\Sigma N_i d_i}{\Sigma N_i}$ where N_i = number of crystals of diameter d_i. The mean quadratic deviation is given by $\sigma = \sqrt{d_e^2 - M^2}$, where d_e = diameter of particles, for which the sum of the weights of fractions from zero up to this diameter is 10% of the weight of all fractions. The coefficient of heterogeneity of the mixture of crystals is the ratio of the mean quadratic deviation to the mean length, expressed as a percentage. The method is exemplified by test data for 1st and 2nd product massecuites and white sugar. It is concluded from these that at a coefficient of heterogeneity of up to 60% the uniformity is adequate for normal factory purposes. Screened white sugar will have a coefficient of about 30%.

* * *

Sugar crystallization—aspects affecting conglomeration. H. E. C. POWERS. *Socker Handl.* II, 1964, **19,** 51–63.—See *I.S.J.*, 1965, **67,** 73–75.

* * *

Kinetics of the formation of colouring matter in the process of sugar degradation. A. R. SAPRONOV and R. A. KOLCHEVA. *Sakhar. Prom.*, 1965, **39,** 22–25. U.V. spectrophotometry was applied to a study of the kinetics of colouring matter formation during heating of glucose and sucrose. The light absorption curves (log D *vs.* wavelength, where D = optical density) obtained when glucose was heated to 100°C in the presence of NaOH showed an initial rise in the maximum absorption corresponding to 290–295 mμ and a minimum at 250 mμ with a shift after 5 min to 270 mμ and 235 mμ respectively. Stability was gained after 6 hr. In the case of glucose heated in the presence of glycine, the initial maximum was 282–285 mμ; this shifted to 295 mμ and became stable after 9 hr, at 285–290 mμ. A rise from a minimum at 250 mμ to the maximum at 282–285 mμ is attributed to the presence of free aminoacetic acid and not to melanoidins, as found by previous authors. With reduction in the glycine content, the gradient of the curves in the short-wave band also decreased. The curves for glucose heated in the presence of cysteine had a configuration after 30 min little different from that for pure cysteine, the path being that of a steep decline; with time this tended to a slightly gentler slope, with a levelling tendency after 1 hr at 270–290 mμ and a maximum of 285 and minimum of 265 mμ after 3 hr, although after 290 mμ the curve regained its initial steepness. At the start of heating of sucrose

(to 185–190°C) there was no change, but with slight coloration of the crystals maxima occurred at 225 and 282 mμ and a minimum at 245 mμ. With a short heating period or low temperature, the maximum at 225 mμ was greater than that at 282 mμ, but with increase in time or temperature the maximum at 282 mμ became the greater; this is ascribed to the similarity in chemical structure between the colour bodies formed at low and at high temperatures, the formation at the lower temperatures being slower. The curves for colour products of sucrose caramelization were similar to those for hydroxymethylfurfural. A test for the presence of hydroxymethylfurfural showed that it is not always possible to judge this from the configuration of spectral curves since other substances may be present with similar absorption curves. Quantitative determination of colour substances by this method is also not highly accurate and it is considered that caramelization products, melanoidins and alkaline degradation products of monosaccharides are of different chemical composition.

* * *

Rapid determination of raffinose. F. SCHNEIDER, A. EMMERICH and C. REICHEL. *Zucker*, 1965, **18,** 37–39. A thin-layer chromatographic method is described in which gypsum is used as carrier and 9:1 acetone: water (Prey's mixture) as solvent. α-Naphthol or naphthoresorcinol in a sulphuric acid-alcohol solution is used as spray reagent. R_f values of 0·15 for raffinose, 0·24 for kestose and 0·70 for sucrose show that the separation is adequate for quantitative visual determination. Reproducibility was ± 0·1% in the range 0–2% raffinose. Comparison of the results with those obtained previously[1] by paper chromatography show that the new method gives values on average 0·1% higher than the earlier values, which were found at the time to be about 0·1% lower than the mean of the most reliable methods. Hence the new method is more accurate. Total time for the method is 2–3 hr. It is suitable for factory routine and normal laboratory investigations.

* * *

Separation of ash and sucrose by gel filtration (in a "Sephadex" column). K. Čížek. *Listy Cukr.*, 1964, **80,** 316–319.—Tests are reported in which aqueous solutions of various refinery and factory products and deionized sucrose, containing known amounts of ash, were passed through a column of "Sephadex G 25" which was then eluted with distilled water. The electrical conductivity and sucrose content (refractometric) of the eluate were then measured. Values of K_D [coefficient expressing the ratio of the quantity of substances separated in static phase (gel) to that separated in mobile phase (solution)] of the technical solutions, ash and sucrose were found to be 0·78, 0·48 and 0·63 respectively. The maximum of the elution curve for ash exceeded that for sucrose. In the sucrose solution the ash aggregates were 15 times larger (radii of 59 and 4 mμ respectively) than the molecules of sucrose and preceded the latter down the "Sephadex" column. In the raw sugar solution the ash aggregates were smaller than 4 mμ, while the apparent molecular size of the sucrose was found to be 32 mμ.

* * *

Validity of the Beer-Lambert law in sugar colorimetry and correlation with the colour of a solution. V. VALTER. *Listy Cukr.*, 1964, **80,** 319–327.—The validity of the Beer-Lambert law concerning the relationship between light intensity and the thickness and colour concentration of the absorbing medium through which it passes was tested for 20 sugar factory solutions. With each sample, the smallest deviation from Beer's law was noted at various wavelengths in the range 525–600 mμ. Over the wavelength range of 551–566 mμ (*cf.* the wavelength of 560 mμ recommended by ICUMSA) there was greatest agreement between the calculated and experimental values, and hence spectral attenuancy was an accurate expression of solution colour.

* * *

Determination of the moisture content of refined sugar cubes (without crushing them). V. N. OSTAPENKO. *Trudy Grupp. Lab.*, 1959, 154–155; through *S.I.A.*, 1964, **26,** Abs. 980.—The moisture content was determined by drying at 105°C for 3–3½ hr or at 130°C for 17 min. The moisture content of cubes which were crushed before drying was 30% less than the moisture content of cubes dried intact, owing to volatilization of moisture. This deviation may account for small unexplained weight losses of sugar in storage. Similar results were obtained at the two drying temperatures, and it was shown that the cubes were dried to constant weight within 20 min. Drying of whole cubes at 130°C for 20 min is therefore recommended for routine moisture determination.

* * *

Determination of sucrose in beet. V. N. OSTAPENKO. *Trudy Grupp. Lab.*, 1959, 74–77; through *S.I.A.*, 1964, **26,** Abs. 981.—Comparative analyses were carried out on beets stored for varying periods by the standard hot digestion method and by the triple polarization method using two enzymes. The two methods gave similar results on fresh beet and beet stored for < 100 days; in the case of beet stored for > 90–100 days, the hot digestion method gave results which were too high by 0·30–0·92% sucrose. Frozen and thawed beets gave results by the hot digestion method which were too high by 1·17–3·04%. The deviation between the results of the two methods was relatively small in the case of decayed beet. It was found, however, by analysis of halved beets in which only one half contained a decayed portion, that the apparent agreement was due to a compensatory effect of laevorotatory substances in the decayed portion on the error produced by dextrorotatory substances in the remainder of the beet. It is concluded that hot digestion is unsuitable for beets stored for long periods or otherwise damaged.

[1] *I.S.J.*, 1959, **61,** 317.

BY-PRODUCTS

A review on the industrial utilization of sugar and sugar by-products. R. R. COVAR and Y. V. IMPROGO. *Proc. 11th Ann. Conv. Philippines Sugar Tech.*, 1963, 336–345.—The literature of by-product utilization is reviewed with 36 references up to 1961.

* * *

Bagasse utilization. C. I. NEE. *Taiwan Sugar Quarterly*, 1964, **11,** (3), 14–23.—Production of bagasse board and furfural is discussed and a detailed account is given of the activities of the Taiwan Sugar Corporation, with the processes used and characteristics of the boards produced. Processes for furfuryl alcohol resin production from bagasse pith are described more briefly.

* * *

Utilization of sugar cane by-products. E. C. VIGNES. *Rev. Agric. Sucr.* (Mauritius), 1964, **43,** 304–312. Development since 1957 of the use of bagasse to produce electric power for the public system is described, as well as the application of molasses in alcohol production and as a fertilizer, and protein extraction from clarifier mud.

* * *

Treatment of beet pulp with aqueous ammonia. V. P. KOLONII. *Zhivotnovod.*, 1964, (1), 8–12; through *S.I.A.*, 1964, **26,** Abs. 871.—Experimental and control groups of young cattle were fed for 100 days on a ration containing 70% of beet pulp, 10% of sugar beet and 20% of maize straw and maize meal. The pulp was acid on account of fermentation in storage, and was neutralized with an equivalent amount of 20% ammonia in the case of the experimental group. The controls received acid pulp. The daily weight increase of the experimental group was 1,186 g compared with 848 g for the control group, owing to the additional protein equivalent in the form of NH_3 in the treated pulp. The weight increase per g of protein equivalent was nearly the same in both groups.

* * *

Nomogram for calculations in the evaluation of silage quality. L. VOKOUNOVÁ. *Listy Cukr.*, 1964, **80,** 327–329.—Nomograms are presented for calculation of the acetic, butyric and lactic acid equivalents in beet pulp silage, and a guide is given to the quality of the silage corresponding to a given range of points values.

* * *

Chemical utilization of sucrose. J. L. HICKSON. *Zeitsch. Zuckerind.*, 1965, **90,** 21–25.—The aims and results achieved in the 20-year programme undertaken by the Sugar Research Foundation since 1943, the 202 projects in which have cost $3·72 million, are surveyed, covering the fields of public health, food uses and non-food uses. Other uses for sucrose still to be fully investigated include: adhesives, plastics and plasticizers, surface-protection materials and surface-active substances. A brief mention is made of the applications of sugar factory by-products.

* * *

Results of tests on inoculation of exhausted beet cossettes from BMA diffusion with cultures of lactic acid bacteria. F. DUDÁŠ and Z. AMBROŽ. *Listy Cukr.*, 1965, **81,** 13–17.—Tests are reported in which beet pulp for silage was inoculated with (1) *Lactobacillus plantarum*, (2) *Lactobacillus delbrücki*, *Lactobacillus casei* and *Streptococcus lactis*, and (3) cabbage water. Each of these three samples was then stored in a 5·5 litre stoppered glass vessel for up to 60 days, samples being taken after 14, 28 and 60 days. The results showed that under optimum conditions the inoculation had no beneficial effect on the quality and food value of the silage. It is considered necessary to continue the tests and observe the effects of longer storage periods.

* * *

Review of the technique of alcoholic fermentation of cane molasses-distiller's yeast. T. S. RAO. *Indian Sugar*, 1964, **14,** 567–569.—A simplified account is given of production of yeast and alcohol by fermentation of molasses.

* * *

Biological preserving of (beet) pulp. A. D. BAGLYUK. *Sakhar. Prom.*, 1965, **39,** 114–115.—Spraying stored beet pulp with a solution containing lactic acid bacteria permitted good preservation of the pulp, which was resilient and looked and smelt fresh. In subsequent cattle feeding tests over 67 days the cattle found the pulp very palatable and the weight increase in both control and test herds was the same. The cost of treating the pulp was extremely low.

* * *

Pulps from bagasse by (the) mechano-chemical process. S. R. D. GUHA and V. B. SAXENA. *Indian Pulp & Paper*, 1962, **17,** 377–378; through *S.I.A.*, 1964, **26,** Abs. 1048.—A mixture of 1000 g of oven-dry whole bagasse with 3 litres of boiling NaOH solution was maintained at 95°C and mechanically disintegrated for 1 hr. A satisfactory cheap-grade writing and printing paper was prepared from the partly bleached pulp, the best result being obtained with 24% of NaOH on dry bagasse. Satisfactory greaseproof papers were also prepared.

* * *

Effect of corn starch in manufacture of greaseproof paper from bagasse. A. K. SANYAL and G. L. KAPUR. *Indian Pulp & Paper*, 1964, **18,** 473–474; through *S.I.A.*, 1964, **26,** Abs. 1049.—The addition of 10% (on pulp) of starch to bleached bagasse pulp prepared from undepithed bagasse by the ordinary soda process resulted in a more transparent greaseproof paper and also improved the tear resistance by 40%.

TRADE NOTICES

Statements published under this heading are based on information supplied by the firm or individual concerned. Literature can generally be obtained on request from the address given.

"Pan-aid". Fabcon Inc., P.O. Box 187, Chagrin Falls, Ohio, 44022 U.S.A.

"Pan-Aid" is a clear free-pouring liquid packaged in 5-gallon containers. Viscosity and surface tension of massecuites are reduced more than 40% using one pint of "Pan-Aid" for 400 cubic feet of *C*-massecuite. This extraordinary drop in viscosity and stickiness can be used to: boil *C*-strikes 10–25% faster, boil to higher Brix with lower massecuite purity, and give better and faster sugar purging. But most important, "Pan-Aid" is guaranteed to lower final molasses purity by at least 1% when used at the level of one pint per 400 cubic feet of *C*-massecuite.

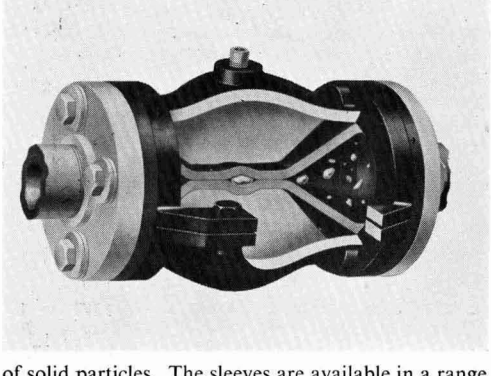
Results in more than 50 factories in the U.S. Mainland, Hawaii and the Caribbean Islands are averaging a 2% drop in final molasses purity.

In *C*-massecuite, based on 1 pint per 400 cubic feet of massecuite, half should be drawn into the pan as molasses is drawn onto the footing. The remaining half is then drawn in toward the end of the strike. For especially fluid massecuite to aid crystallization, cooling, and drying, an additional half pint may be added no more than 2 minutes before breaking vacuum to drop the strike, or may be added directly to the crystallizer itself. In *A*- and *B*-massecuites ½ pint of "Pan-Aid" per 400 cubic feet of massecuite should be added midway during the boiling.

* * *

Flow control. G. A. Platon Ltd., 281 Davidson Rd., Croydon, Surrey.

The rubber sleeve of the "Red Jacket" valve is pinched by the action of compressed air or hydraulic fluid, this pinching being effective despite the presence



of solid particles. The sleeves are available in a range of materials, and the valves are suitable for abrasive slurries, dry powders and especially liquids which deposit scale such as milk-of-lime. It is available for pipe sizes of 1 to 72 inches.

The "Manostat" is a compact and accurate air pressure regulator for a flow range of 0–6 c.f.m. and is available in three pressure ranges. It is a bleed-type regulator with a high-gain servo mechanism whereby the regulated pressure (not the supply pressure) is used to load the pilot diaphragm: this results in higher response speed with greater stability and accuracy, no matter how small the flow rate.

* * *

Pocket refractometer. Paul Delapena Ltd., Elmley Castle, Pershore, Worcs.

The Bleeker pocket refractometer is an accurate, low-cost, easily-used instrument for measuring the percentage of solids in liquid solutions. It is 6¼ inches long and gives direct percentage readings accurate to ±0·1% (0·1°Bx). To check a solution, several drops of the liquid are placed between two hinged

prisms. The operator then looks through the focussing eye-piece towards a light source to read the solids percentage from the scale. After use the prisms are easily cleaned with water and a soft cloth. Four models are available, covering the ranges 0–45%, 25–65% and 45–85% with 1% scale graduations, and 0–25% with ½% graduations. With the refractometer are supplied a leather carrying case, instruction manual and temperature correction tables.

* * *

"Sealtite" gasket and jointing material. Polypenco Ltd., Gate House, Welwyn Garden City, Herts.

"Sealtite" is a specially processed P.T.F.E. tape with a ⅛ inch diameter half-round section provided in 12-ft lengths on covered spools. It is soft and flexible so that it forms a perfect gasket swiftly and simply. Being chemically inert, non-toxic and heat resistant, it is ideal for applications in the sugar industry, and will seal against all acids, alkalis, solvents, steam and gases through a temperature

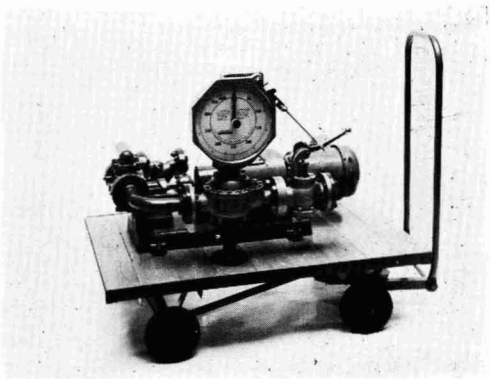
range of —250° to +250°C (—420° to +480°F) and at working pressures of 500 p.s.i. and more.

The "Sealtite" tape is simply placed on one face of the joint flange with the ends overlapping, and the two faces bolted together; the tape is compressed to form a perfect seal which may be broken cleanly even after years without difficulty. It may be used on any flanged joint or split casing, and may also be used for valve stem packing. A similar material, "Fluoroseal", is available as a pipe thread seal tape.

* * *

Portable metering unit. Jobson & Beckwith Ltd., 62 Southwark Bridge Rd., London S.E.1.

The portable metering unit illustrated is one of a series developed by Jobson & Beckwith Ltd., the London pump engineers. Its graduated dial can be set to any quantity between 0 and 500 gallons and the pump will then automatically deliver the required quantity. When the valve shuts off the supply, the



pump recirculates the liquid while the pipelines are being moved and the next required quantity is pre-set on the dial. The maximum rate of flow is 24 g.p.m. of a liquid with a viscosity of 300 seconds Redwood No. 1, but the pump installed, a "Rotan RT 32" with 1½-inch ports, can handle viscosities up to 25,000 seconds Redwood No. 1. Larger pumps can be fitted to provide flow rates up to 110 g.p.m.

* * *

Soil drainage pipes. Standard Telephones and Cables Ltd., Connaught House, 63 Aldwych, London, W.C.2.

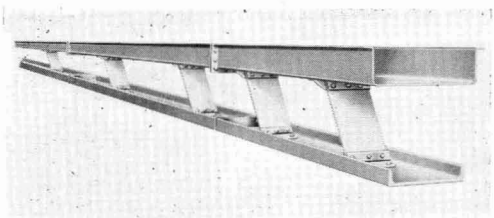
"Pipaway" tiles comprise 20-ft long, 2-in diameter pipes made of Shell "Carag" material. The pipes have a large number of water intake points and have proved more efficient at removing water from wet soil than the 3-in clay tile pipes previously used for land drainage.

"Pipaway" offers big advantages to both drainage contractor and farmer. The pipes are only one-thirtieth the weight of clay tile pipes; this means cheaper transportation, easier handling and fewer men on installation. Jointing is simple and fool-proof because each pipe has a bell-shaped end and a plain end; the joint is made merely by pushing one into the other. Tight-fitting joints and specially designed slots for water entry practically eliminate the build-up of silt. Virtually unbreakable, "Pipaway" withstands all normal conditions met in installation and use. Dropped on concrete in sub-zero temperatures, the pipes neither chip nor shatter. Underground, they flex to earth movements, retain their shape and resist misalignment. The system can therefore be installed at any time of the year.

* * *

"Vibraline" vibrating conveyors. Stephens-Adamson Manufacturing Co., Aurora, Ill., U.S.A.

A new range of natural frequency vibrating conveyors for lighter duty applications has been announced by Stephens-Adamson Mfg. Co., the units being available in 8, 12, 18 and 24-inch widths and



in standard lengths which are easily assembled on site to provide the total length required. The conveyors will handle hot, cold or abrasive materials, and are self-cleaning because their straight-side troughs are fabricated in one piece to give crevice-free conveying.

Resilient "Scotch ply" leaf spring stabilizers support the troughs and regenerate power, while a constant stroke eccentric drive is pre-set to give the desired conveying speed. The conveyors are described in Bulletin 564.

* * *

3000 British crop sprayers for Pakistan. Kent Engineering & Foundry Ltd., Maidstone, Kent.

Three thousand Kent "Motoblo Junior 35" knapsack crop-spraying and -dusting machines have been delivered recently to The East Pakistan Development Corporation. The "Motoblo Junior 35" is inexpensive yet versatile, easy to use and backed by an efficient service organization and is particularly suitable for all row crops. The unit is simple in design, which makes it ideal for use by unskilled labour. Weighing only 16½ lb, the machine is fitted with a 2 h.p. two-stroke engine and special air cleaners to protect the engine in dusty conditions.

PUBLICATIONS RECEIVED

A BRIEF GUIDE TO THE BROOKS PRODUCT LINE. Brooks Instrument N.V., Veenendaal, Holland.

This new Bulletin, No. SPE-110, lists the Company's various products in flow, level and temperature instrumentation, presenting a brief summary of indicating, alarm and transmitting units designed for many processing and laboratory applications.

* * *

JABSCO SELF-PRIMING PUMPS. Jabsco Pump Co. Ltd., Cadmore Lane, Cheshunt, Herts.

The advantages of the Jabsco pump are described and illustrated in a new leaflet which also provides specifications, dimensions, etc. of the plain and ball bearing models, and a list of applications which includes pumping of juices, syrups, molasses, slurries, irrigation water, etc. The only moving part is a tough neoprene impeller, splined on to the drive shaft and moving inside a housing with a removable end-plate for easy replacement or service. At the top of the housing, between the inlet and exit ports, is an offset plate which presents a concave surface towards the centre of the housing. The impeller has the appearance of a gear pump impeller and its "teeth" are bent by the offset plate as it rotates in the housing. Restoration of its normal shape past the plate creates a vacuum which draws fluid into the space between the "teeth" to be carried round the housing and expelled when the offset plate again deforms the "tooth" leading the space.

* * *

AUTOMATION BY APV. The A.P.V. Co. Ltd., Manor Royal, Crawley, Sussex.

A new brochure, No. A.388, discusses the advantages which are resulting from automation in industry, particularly the potable liquid processing industries and illustrates the work of A.P.V. in such installations. Control equipment available is described and illustrated, including circuit selection and checking, programmers, control panels, sensing devices for liquid level, pressure, and weight, air-operated valves, pipe fittings, pumps, tanks, etc.

* * *

TECHNICAL SERVICE TO THE SUGAR INDUSTRY. American Factors Associates Ltd., P.O. Box 3230, Honolulu, Hawaii, 96801 U.S.A.

During the past six years since its formation, American Factors Associates have enjoyed increasing growth as international sugar consultants and agricultural property managers, serving clients in Argentina, Australia, Bolivia, Colombia, Honduras, India, Mexico, Peru, Taiwan, Uruguay and Venezuela. The Company has now produced a new booklet outlining and illustrating features of the services which it has to offer from land use surveys to agricultural and factory operations, personnel training, by-product development, etc. The offer is made, without obligation to the enquirer, to submit a preliminary proposal for use of these services in response to a description of the problem to be solved.

* * *

APPLICATIONS UNLIMITED. Kenite Corporation, Overhill Building, Scarsdale, N.Y., 10583 U.S.A.

The nature of diatomite and its formation are described in this new booklet which is devoted to various grades of "Kenite", a practically pure amorphous diatomaceous silica obtained from deposits at Quincy, Wash., U.S.A. These yield ores of especially high value as filter aid for sugar juices, syrups, molasses, etc., both as a batch aid and pre-coat. Permeability and flow ratio data are presented in graph form with specifications of the individual grades of "Kenite".

* * *

HOLROYD MOTORIZED WORMGEAR SPEED REDUCERS. John Holroyd & Co. Ltd., Milnrow, Rochdale, Lancs.

This new publication, No. M 65, shows examples of the many driving arrangements possible by flange mounting motors direct onto the standard Holroyd wormgear speed reducers. They range from small power units with 1⅛-in centres to large heavy-duty industrial units. The very compact method of driving is illustrated, with single- and double-reduction applications, units with vertical input and output shafts, etc.

RING DIFFUSION—THE NEW SENSATION IN CANE. Silver Engineering Works Inc., 3309 Blake Street, Denver, Colo., 80205 U.S.A.

This new leaflet illustrates the Silver ring diffuser installed at Pioneer Mill Company, Hawaii[1], and provides information on the sizes of unit available, a schematic flow diagram, etc.

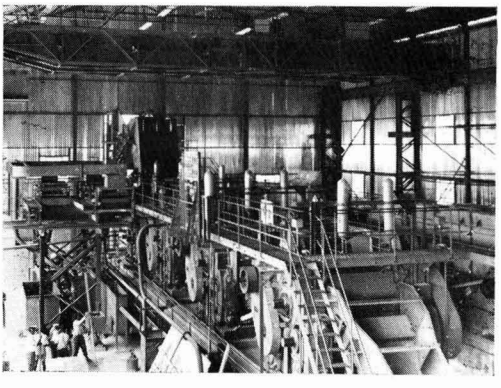
* * *

WORTHINGTON SERVES THE CANE SUGAR INDUSTRY. Worthington Corporation, Harrison, N.J., U.S.A.

A list is presented of applications in the sugar industry for Worthington power plants, steam turbine drives, pumps, process controls, general service equipment, etc., these also being illustrated by a raw sugar mill layout in which Worthington equipment is indicated in colour. The booklet finally shows a series of photographs taken of Worthington plant in a number of sugar factories in the U.S.A., Mauritius and Peru.

* * *

Sugar in Nigeria.—The illustration shows the interior of the mill house of the Bacita sugar factory of the Nigerian Sugar Company[2]. The factory was erected by Taylor Woodrow Construction Ltd. under the supervision of experts from



Fletcher & Stewart Ltd. who supplied the machinery. The new factory is equipped to crush 2000 tons of cane per day to produce 30,000 tons of white sugar a year, and is designed for easy expansion to double this production. The tandem is a 34 × 66 in unit of four mills.

* * *

European licence for screens and filter media.—Cocksedge & Co. Ltd. of Ipswich have been appointed by Multi-Metal Wire Cloth Inc., of Tappan, N.Y., U.S.A., as their exclusive stockist-distributor-representative for Western Europe, excluding Scandinavia, and the Middle East. Multi-Metal products to be handled include "Neva-Clog" filter media for use in carbon and/or ion exchange treatment processes, "MerMade" plastic filter leaves for diatomite vacuum filters, and filter leaves and tubular filter elements in stainless steel, brass or other alloys, covered with metal filter cloths or synthetic fabrics.

* * *

Czech sugar factories for Egypt[3].—The number of existing Egyptian sugar factories fitted out with Czechoslovak equipment will be increased by complete sugar factories at Deshna and Baliana. The sugar factory at Deshna, start-up of which is planned for 1st January 1968, will have a daily capacity of 8000 tons of cane and the factory at Baliana, due to commence on 1st January 1970, will process 12,000 tons of cane per day.

[1] *I.S.J.*, 1965, **67**, 169–172.
[2] See also *I.S.J.*, 1965, **67**, 114.
[3] *Czechoslovak Heavy Ind.*, 1965, (6), 24.

French Sugar Imports and Exports[1]

Metric tons, tel quel

Imports	1964 *Unrefined*	1964 *Refined*	1963 *Unrefined*	1963 *Refined*
Belgium/Luxembourg	1	227	48	583
Brazil	5,250	—	4,212	—
Bulgaria	—	—	3,000	—
Dominican Republic	21,275	21	—	—
Germany, East	—	—	1,105	—
Guadeloupe	125,859	—	85,125	—
Guatemala	11,000	—	—	—
Haiti	2,683	—	—	—
Honduras	3,000	—	—	—
Hungary	—	—	998	—
Malgache Republic	34,326	100	33,659	300
Martinique	52,720	—	74,807	—
Mexico	7,925	—	—	—
Poland	—	11	2,375	126
Réunion	166,972	—	177,963	—
Taiwan	20,824	—	—	—
Thailand	9,934	—	—	—
Other Countries	8	—	1,149	58
	461,777	359	384,441	1,067
Exports				
Algeria	84,244	69,940	129,892	57,273
Bahrain	400	—	—	—
Belgium/Luxembourg	3,267	9,928	8,109	7,560
Cameroons	1,157	7,364	1,210	8,370
Chile	—	—	9,503	—
Dahomey	211	4,869	515	7,246
Denmark	2,495	20	5,411	—
French Oceania	468	1,631	834	896
Gabon	150	1,100	132	885
Germany, West	31,245	2,797	66,160	16,870
Ghana	—	9,462	—	6,626
Greece	100	18,764	500	13,556
Guinea	647	4,572	911	3,427
Iran	5,750	8,894	9,500	—
Ireland	1,923	—	18,051	—
Israel	—	14	16,498	2
Italy	28,057	33,169	52,780	30,228
Ivory Coast	3,431	7,268	5,031	13,096
Kuwait	1,100	21	—	—
Liberia	—	1,136	—	1,101
Libya	9,905	1	—	—
Mali	—	2,663	—	4
Mauritania	—	3,875	1	7,994
Morocco	28,000	25,989	50	21,341
Netherlands	5,462	3,325	2,736	42,267
New Caledonia	1,072	1,118	1,693	1,101
Niger Republic	1,488	3,272	1,185	7,232
Nigeria	—	8,670	—	12,580
Norway	—	3,195	3,688	2,245
Senegal	25,124	29,624	19,116	32,758
Sierra Leone	—	2,902	—	4,536
Spain	1,800	262	5,783	—
Sudan	12,574	—	17,400	5,000
Sweden	2,730	2	22,689	1,161
Switzerland	5,454	81,013	7,916	67,137
Togo	373	3,193	147	2,598
Tunisia	1	1	6,749	50
United Kingdom	4,923	2,305	1,956	4,358
Upper Volta Republic	370	6,100	—	6,090
U.S.A.	1,000	1,846	9,652	24,809
Other Countries	241	2,584	712	1,877
	265,162	362,889	426,510	412,274

Cane diffusion in India[2].—A spokesman of the Co-operative sugar factory in Phaltan, Maharashtra, said at New Delhi on the 4th April that a most modern cane diffusion plant would be installed by his factory. The plant, which would be set up on a trial basis, is expected to give an extraction of at least 97% and is to have a cane capacity of 1250 metric tons per day.

Brevities

Erratum.—The last line of column 2 on page 170 of our June 1965 issue should read as follows:—

Bagasse moisture..... 49·2 46·9

* * *

New sugar factory for Colombia[3].—Construction of a sugar factory is planned in the Zulia valley on the border between Colombia and Venezuela. Finance for the project will be provided by both countries and a plan is being considered whereby farmers in the area will be granted credits to encourage cane cultivation.

* * *

The Antigua Sugar Factory Ltd., 1964 report.—The crop started on 31st January 1964 and finished on 27th June 1964 with a total output of 21,074 tons of commercial sugar (equivalent to 21,160 tons on a 96 pol basis), produced from 191,661 tons of cane, compared with 27,958 tons of sugar produced from 255,354 tons of cane in 1963. The sucrose in cane was higher at 12·63% compared with 12·46%, although recovery was lower at 83·89% compared with 84·38%. Total sugar production in 1965 is not expected to exceed 13,000 tons.

* * *

New sugar factory in Chile[4].—A beet sugar factory is to be set up at Cocharcas, near Chillán, with a daily slice of 3000 tons of beet. The total area sown to beet is to be increased from 18,000 to 33,000 hectares.

* * *

Sugar refinery for Mozambique[5].—A sugar refinery is to be installed at Manica by a South African consortium for a Portuguese firm Marracuene Agricola Açucareira. The refinery will be able to produce 60,000 tons of sugar a year by 1967.

* * *

New distillery for Jamaica[6].—During the year a distillery is to be erected at Innswood Estate in Jamaica; the cost is expected to be £250,000.

* * *

Angola sugar expansion[7].—The Cía. do Açucar de Angola is to purchase equipment valued at £750,000 from a British firm to modernize its factories. With the new equipment the Company expects to increase its annual production of sugar from 10,000 to 15,000 tons.

* * *

Bagasse hardboard in Trinidad[8].—Trinidad Board and Tubes has been formed with a capital of T.T.$5 million to manufacture hardboard, wallboard and softboard from bagasse.

* * *

Sugar factory for Malawi.—Lonrho Ltd. has signed a contract to supply and install a complete sugar factory for the Sugar Corporation of Malawi. The factory is to be built at Nchalo and is scheduled to commence operations in July 1966. The initial capacity will be 1000 tons of cane per day, to be increased later to 1500 tons, when sufficient sugar should be produced to meet domestic requirements in Malawi.

* * *

Peru sugar production, 1964[9].—Production of sugar in Peru in 1964 is estimated at 834,618 metric tons, some 7000 tons lower than in 1963. Shipments in 1964 amounted to 416,326 tons, compared with 638,154 tons in 1963.

[1] C. Czarnikow Ltd., *Sugar Review*, 1965, (703), 52.
[2] *Indian Sugar*, 1965, **15**, 8.
[3] C. Czarnikow Ltd., *Sugar Review*, 1965, (705), 61.
[4] *Fortnightly Review* (Bank of London & S. America Ltd.), 1965, **30**, 242.
[6] *Fortnightly Review* (Bank of London & S. America Ltd.), 1965, **30**, 379.
[5] *Overseas Review* (Barclays D.C.O.), May 1965, p. 71.
[7] *Fortnightly Review* (Bank of London & S. America Ltd.), 1965, **30**, 379.
[8] *Fortnightly Review* (Bank of London & S. America Ltd.), 1965, **30**, 395.
[9] *Fortnightly Review* (Bank of London & S. America Ltd.), 1965, **30**, 422.

BREVITIES

Pakistan sugar industry expansion[1].—The Industrial Development Corporation has decided to erect three sugar factories with a production capacity of 35,000 tons a year. The factories are to be built at Nilphamari, Shyampur (Dist. Rangpur) and Kalichapra (Dist. Mymensingh). Two factories are already being built at Jessore and Mobarakganj with a possible output of 20,000 tons a year. In the campaign year 1962/63 292,949 tons were produced in Pakistan but an estimated 349,000 tons were consumed. The erection of new factories will permit the coverage of requirements by domestic production.

* * *

Beet sugar in India[2].—It is reported that a pilot beet sugar factory is being constructed at Yamunanagar in the Punjab. Some of the equipment is being imported from Denmark but the remainder is to be manufactured in India. Sugar production is scheduled to commence next year and already field trials on imported West German beet seed have been carried out in the vicinity of the factory and at Himachal Pradesh.

* * *

Iraq sugar factory[3].—Hawaiian Agronomics International is to build a sugar factory at Amara for the Iraq Ministry of Agriculture. It is to be finished in 1969 and will cost about ten million dinars. Some 32,500 tons of sugar will be produced from cane grown on 5000 ha of land in the area of Nahiya, and 70,000 tons will be produced by refining imported raw sugar. The Hawaiian Company will manage the factory for six years. It is planned to extend the cane area to 11,750 ha for supplying other factories.

Stock Exchange Quotations

CLOSING MIDDLE

London Stocks (*at 17th June* 1965)	s d
Anglo-Ceylon (5s)	5/3
Antigua Sugar Factory (£1)	8/9
Booker Bros. (10s)	18/–
British Sugar Corp. Ltd. (£1)	21/4½
Caroni Ord. (2s)	2/–
Caroni 6% Cum. Pref. (£1)	16/4½
Demerara Co. (Holdings) Ltd.	3/11¼
Distillers Co. Ltd. (10s units)	21/7½
Gledhow Chaka's Kraal (R1)	16/3
Hulett & Sons (R1)	22/–
Jamaica Sugar Estates Ltd. (5s units)	3/9
Leach's Argentine (10s units)	17/–
Manbré & Garton Ltd. (10s)	31/4½
Reynolds Bros. (R1)	16/3
St. Kitts (London) Ltd. (£1)	13/3
Sena Sugar Estates Ltd. (5s)	7/–
Tate & Lyle Ltd. (£1)	31/6
Trinidad Sugar (5s stock units)	2/–
West Indies Sugar Co. Ltd. (£1)	9/4½

CLOSING MIDDLE

New York Stocks (*at 16th June* 1965)	$
American Crystal ($5)	17⅜
Amer. Sugar Ref. Co. ($12.50)	21⅛
Central Aguirre ($5)	25
Great Western Sugar Co.	40⅜
North American Ind. ($10)	13½
South P.R. Sugar Co.	22¼
United Fruit Co.	19

Japan sugar imports, 1964[4].—Imports of sugar into Japan totalled 1,541,062 metric tons, tel quel, in 1964, most of this coming from four sources: Australia (430,254 tons), Cuba (335,695 tons), South Africa (216,089 tons) and Taiwan (341,472 tons). The Ryukyu Islands supplied 142,582 tons, while smaller amounts were supplied by India, Indonesia, Thailand, China, the U.K., Hong Kong, etc.

* * *

New sugar factories for Brazil[5].—The Commission for Competitive Bidding for the Installation of New Sugar Mills, established in April 1964 as a branch of the I.A.A., recently approved the installation of 31 new sugar mills. They are to be Government-financed and will be set up in southern and central Brazil. The projects, which require final approval by the Executive Commission of the I.A.A., include 10 mills for the State of Paraná, 9 for São Paulo, 6 for Minas Gerais, and 1 each for Pará, Espirito Santo, Mato Grosso and the territory of Amapá. Brazil now produces almost 4 million short tons, raw value, of sugar per year and exports 600,000 tons. Because of the administration's plan to substitute sugar for coffee on unproductive plantations, some 50 additional mills may be called for.

* * *

New sugar factories for Yugoslavia[6].—A sugar factory is to be built at Bijeljina, and it is expected that a further three will be supplied by Poland and erected in the neighbourhood of Pozarevac and Virovitica.

* * *

Indian sugar factories[7].—The Indian Minister for Food and Agriculture inaugurated two new sugar factories in Madras on the 19th March. One is a privately owned sugar factory at Appakudal which cost £1,275,000 and will have an annual production capacity of 14,000 metric tons. The second is a co-operative mill at Mohanur, costing £1,200,000 and can crush 1000 metric tons of cane per day. The Madras State authorities plan to build four sugar factories in the public sector[8]. In addition to these it is hoped to set up three co-operative sugar mills, according to the Indian Sugar Mills Association. At present there are nine sugar factories in Madras and cane is cultivated in an area amounting to some 200,000 acres. Sugar production in India is reported to have reached 3,096,000 tons by the end of May, which compares with a final production of 2,570,000 tons for the previous season.

* * *

Bagasse paper in India[9].—A paper factory is to be set up in Maharashtra as a joint venture of four sugar mills. It will have a capacity of 36,000 metric tons of paper per year and will cost nearly £11,000,000. The factory will use bagasse as its main raw material and will be erected by Bharat Co-operative Paper Mills Ltd. in Kolhapur, Satara or Sangli district.

* * *

Bagasse board for Mauritius[10].—A group of sugar mills is studying the possibility of installing a plant to manufacture particle board using bagasse as a raw material. The plan envisages the use of around 40,000 tons of bagasse to manufacture some 28,000 cubic metres of board of various thicknesses. A delegation from Mauritius recently visited Italy to see the results obtained in a pilot plant using bagasse imported from Mauritius and to discuss a range of technical problems.

[1] F. O. Licht, *International Sugar Rpt.*, 1965, **97**, (7), 14.
[2] C. Czarnikow Ltd., *Sugar Review*, 1965, (713), 93.
[3] F. O. Licht, *International Sugar Rpt.*, 1965, **97**, (7), 15.
[4] *Willett & Gray*, 1965, **89**, 162.
[5] F. O. Licht, *International Sugar Rpt.*, 1965, **97**, (7), 13.
[6] *Zeitsch. Zuckerind.*, 1965, **90**, 215.
[7] *Indian Sugar*, 1965, **14**, 780.
[8] C. Czarnikow Ltd., *Sugar Review*, 1965, (717), 109.
[9] *Indian Sugar*, 1965, **15**, 9.
[10] *Sugar y Azúcar*, 1965, **60**, (6), 77.