International Sugar Journal

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

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

VOL 65 — *March, 1963* — No. 771

THE INTERNATIONAL SUGAR JOURNAL

VOL. LXV — MARCH, 1963 — No. 771

NOTES AND COMMENTS

Japanese sugar imports[1].

Japanese sugar refineries, which used to import one third of their annual raw sugar requirements from Cuba, have recently completed arrangements to shift the bulk of their purchases to south-east Asia and South Africa, according to a report in the *Far Eastern Economic Review*.

To meet raw sugar requirements for 1963 estimated at 1,200,000 to 1,250,000 tons, the refineries have so far arranged to import 500,000 tons from Taiwan, 300,000 tons from Australia, 188,000 tons from South Africa, 78,000 tons from India and 35,000 tons from Siam. Further purchases from South-east Asian countries are expected.

The Ministry of International Trade and Industry is actively encouraging the purchase of raw sugar from South-east Asia. With bumper rice crops Japan no longer requires rice in the quantities it used to import from Burma and Siam, and officials have been continually looking to alternative imports from these and other South-east Asian countries in order to help correct the lopsidedly favourable balance of trade which Japan presently enjoys.

In the past, Japanese refineries found Cuban sugar cheaper than any other. Today, however, they are concerned both over political and economic instability in Cuba, and the possibility that when trade in sugar is liberalized South-east Asian producers may drop prices in a scramble for the Japanese market.

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U.S. sugar quotas, 1963.

The U.S. import fee was suspended for three weeks on the 23rd January. The fee of 1.40 cents per lb had clearly been inappropriate in the circumstances, as was shown by the small proportion of global quota taken up by suppliers prior to the 23rd. Almost immediately the balance of the 750,000 tons were taken up and it was reported on the 29th that authorizations had been made for the total on the 25th and 28th.

On the 31st January the global quota was increased by a further 350,000 tons, and it was stated that the entire amount had been taken up by the evening of February 1st. The quotas for all territories, calculated by C. Czarnikow Ltd.[2], are as follows:

Short tons raw value	*Statutory Quotas*	*Global Quotas*	*Total*
Domestic Beet	2,698,590	—	2,698,590
Mainland Cane	911,410	—	911,410
Puerto Rico	1,140,000	—	1,140,000
Hawaii	1,110,000	—	1,110,000
Virgin Islands	15,000	—	15,000
Philippines	1,050,000	—	1,050,000
Ireland	10,000	—	10,000
Canada	631*	—	631*
United Kingdom	516*	—	516*
Belgium	182	7,622	7,804
Hong Kong	3*	—	3*
Argentina	20,000	13,559	33,559
Dominican Republic	322,152	172,623	494,775
Peru	192,152	184,388	376,540
Mexico	192,152	—	192,152
Brazil	182,416	282,659	465,075
B.W.I./Br. Guiana	91,351	—	91,351
Australia	40,378	86,672	127,050
Taiwan	35,510	31,500	67,010
French West Indies	30,355	65,849	96,204
Colombia	30,355	46,144	76,499
Nicaragua	25,200	15,300	40,500
Costa Rica	25,200	10,100	35,300
Ecuador	25,200	18,272	43,472
India	20,332	53,000	73,332
Haiti	20,332	5,854	26,186
Guatemala	20,332	12,780	33,112
South Africa	20,332	52,163	72,495
Panama	15,177	—	15,177
El Salvador	10,309	6,500	16,809
Paraguay	10,023	—	10,023
British Honduras	10,023	—	10,023
Fiji	10,023	12,230	22,253
Netherlands	10,023*	—	10,023*
France	—	12,285	12,285
Réunion	—	10,500	10,500
Not yet released	—	404,341	404,341
	8,295,659	1,504,341	9,800,000

* Withheld from net importing countries

Czarnikow also comment that "No suprises appear amongst the list of suppliers (of global quota sugar), although it was to be noted that Mexico, which country recently announced that exports this year would go exclusively to the United States, was

[1] *The Times*, 2nd January 1963.

[2] *Sugar Review*, 1963, (596), 32.

not included. . . . Of the total 1·1 million tons, 164,344 tons is scheduled to arrive during August and no less than 247,730 tons in September."

The London Terminal Price rose at the beginning of February to no less than £51 per ton, c.i.f. U.K. This corresponds to a value of 6·01 cents per lb, f.o.b. and stowed Caribbean area, while the No. 7 spot price in New York corresponds to only 5·80 cents. Consequently a supplier selling on the U.S. market is subject to a discount of about 20 points compared with the price he could obtain on the world market. There is one major reason why U.S. prices have not already advanced sharply to equal the comparable world price, in the opinion of B. W. Dyer & Company, sugar economists and brokers, namely, prospects of an eventual return to premium prices in the U.S. market compel farsighted suppliers to build up performance records for display when Congress reviews the allocation of basic quotas some time before 31st December, 1964.

There is some precedent for this opinion; in 1957, following the poor European beet crop and the Suez crisis, all the sugar needed by the U.S. was covered by quotas. Although the world price briefly rose above the U.S. price, quota countries continued to fill their U.S. quotas at the lower prices in hopes of establishing a favourable record for quota consideration under future sugar legislation.

Today, however, the global-quota portion of the U.S.' current 1963 sugar needs, 1,504,341 tons, is open to all friendly suppliers. Except for basic quotas, which are subject to reduction in future years to the extent they are not filled in 1963 (under Section 202*d*) there is little incentive for countries to sell sugar to the U.S. at less than the corresponding world market price, because global quotas are earmarked for return to Cuba, when and if the U.S. re-establishes diplomatic relations with that country.

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Mauritius sugar crop 1962[1].

The 1962 crop started on 26th June and ended on 24th December. The 23 mills together crushed 4,551,660 tons of canes, i.e. about 300,000 tons less than the preceding year. Total sugar produced amounted to 524,248 long tons (as against 544,546 in 1961), which represents an average sugar recovery of 11·52%.

The cyclone which hit Mauritius last February had a marked influence on cane yields, especially on the central plateau and on the southern slopes; the average yield for the whole island was only 22·6 tons per acre, the lowest figure in ten years, excluding 1960 which was the worst cyclone year on record.

As regards sucrose content, the effects of the cyclone were enhanced by the unfavourable climatic conditions which prevailed during the last three months of the campaign. The sugar recovery % canes as given is well below the average figure of 12·57 for the period 1956–59. Consequently, sugar yield per acre (on 201,177 acres harvested, as against 195,341 in 1961) amounted to 2·60 tons, which is even lower than the already poor yield recorded during the previous campaign.

The above figures are based on a preliminary compilation of the data supplied by all sugar mills; the sugar tonnage is liable to a slight adjustment when final dock weights are known.

Fairly heavy rainfall was registered all over the island during the last week of December. On the whole, the standing crop for 1963 looks promising.

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New York refinery modernization.

The National Sugar Refining Company is to carry forward a comprehensive three-year modernization programme at its New York refinery at a cost of $9,000,000. Of this sum, it plans to borrow $5,000,000 on a long-term basis, and the remaining $4,000,000 will be supplied from net current assets which, as a result of the sale of the Reserve refinery, Louisiana, exceed present and projected needs for working capital.

Most of the equipment, systems and construction materials which it is planned to introduce have now been intensively tested in use so that those which have given satisfactory results can be selected.

Because it is essential for the Company to maintain its competitive position in the New York metropolitan markets, operations at the refinery will continue while the modernization programme is in process.

Present equipment for the unloading of raw sugar, the affination and filtration processes, and the packaging plant meet the highest standards of modern operation as a result of construction completed or already in process. The new project involves mainly the replacement of all equipment necessary for the crystallization of white granulated sugar. It includes installation of vacuum pans, centrifugal machines, granulators, and screening equipment, together with corollary power facilities.

The first step will be the installation of new steam and electrical generating equipment in an existing building well suited to house this equipment. The new crystallization equipment will then be placed in the present steam boiler house. By using existing buildings, a substantial saving in construction costs will be achieved, and unpredictable foundation problems, inherent in the building of any new structure located on the waterfront, will be eliminated. Work on the project is scheduled to begin in early 1963 and is expected to be completed in the middle of 1965.

The project has been planned to produce a yearly output of 350,000 tons at the New York refinery, on a fifty-week, five-day operating basis. This is somewhat less than this refinery has produced in past years, but if market conditions dictate, it will be possible to increase output efficiency by longer operating schedules.

While the New York refinery is being modernized, Philadelphia refinery improvements will be carried forward with funds provided by depreciation charges.

[1] *Mauritius Sugar News Bull.*, 1962, (12).

THE EFFECT OF GROWING ONE CANE VARIETY IN PROXIMITY TO ANOTHER

By Dr. WILLIAM E. CROSS

IN the early years of my work on new varieties of cane in Tucumán, some of the growers to whom we had given our best canes to try out reported that one or more of them showed very poor growth. On investigating the matter, we found that they had planted the different canes in rows fairly close to each other (around five feet apart), with one row of each variety, and that the canes which had developed badly had been planted between two especially vigorous varieties. We made experiments to investigate whether one cane could affect the growth of another planted in the row adjacent to it, and found it to be so, to a greater or lesser extent, with nearly all the varieties included in these tests. In the extreme case almost any variety, even normally very productive ones such as POJ 36, POJ 213, and POJ 2878, planted in a row between two rows of very vigorous canes like Kavangire, Zwinga or Kassoer, developed very poorly, and produced only a small tonnage in the harvest.

These results showed that the method of trying out new varieties, frequently used on the plantations, and even in some experiment stations, by planting one row of cane of each kind side by side in an experimental plot, cannot give reliable data as to the respective value of the different varieties, unless of course the distance between the rows is much greater than usual. Even if the experiments are carried out by planting each variety in plots of three or more short rows, these plots must be separated, both at the side of the rows and at the ends, by a distance of at least ten feet.

I am afraid this necessity of separating well the rows or plots of varieties to be tested is not always recognized or kept in mind. For instance, in one experiment station report I read recently, it said that the method of planting in plots of each variety was used, the plots being properly duplicated and distributed, and the varieties tested being the "nine best" of their collection of 150 canes. But the determination as to which were the "nine best" was made on the basis of the results obtained in a plantation of one row of each of all these varieties, with a distance of five feet between the rows. It would appear probable that if these 150 varieties had been planted in such a way as to be duly separated one from another, the "nine best" selected for further testing might have been different from those employed.

We obtained more information on this matter from some experiments we made on a method, invented by some cane growers, of preventing the lodging of the valuable POJ 213 cane, by planting it in the same rows with the upright growing POJ 36. In these experiments, in each row of several plots we planted in continuous lines, side by side, one stalk of each of these two canes. The plots were cultivated in the usual way, and the experiments continued until the sixth stubble year, during the whole of which period the method was quite successful in preventing the lodging of the POJ 213 cane. In order to find out to what extent these two varieties, grown in such close proximity, "cohabited" with each other, or whether one competed with, and perhaps overcame the other, in the harvest of each year we separated the stalks of the two varieties, and counted, weighed and analysed them separately. The results showed that in the first harvest 36·4% of the stalks and 40·9% of the total tonnage produced was of POJ 36, and 63·6% of the stalks and 59·1% of the tonnage of POJ 213. This proportion was maintained during the whole of the seven years, as the average of all these crops was: POJ 36, 36·6% of the stalks and 41·3% of the tonnage; POJ 213, 63·4% of the stalks and 58·7% of the tonnage. It thus appeared that these two canes, cultivated in close association with each other, grew in perfect harmony, neither of them affecting the yields of the other in any way.

Some years later, after the cane smut invaded the Argentine, the POJ canes mentioned were replaced by other, resistant varieties, and one of these, which came to be planted on a large scale, was Tuc. 1406, which also had the defect of lodging heavily with high winds. To prevent this, we decided to try the same method which had been successful with the POJ 213, i.e. that of planting it together with other, non-lodging, commercial varieties, in the same row, selecting for this purpose POJ 2725, Tuc. 1149, and Tuc. 2683. In one series of the experiments, one continuous line of Tuc. 1406, and one of the upright growing variety, were planted in each row; and in a second series we planted one continuous line of Tuc. 1406 between two continuous lines of the other cane. In each experiment, in a part of the plot, as a check, the Tuc. 1406 was planted alone, two continuous lines being used in the first series, and three in the second. The canes were cultivated in the usual way, and cropped as plant cane, and as first year stubble. As in the experiments with POJ 213, in the harvests we separated the stalks of the different canes, and counted, weighed, and analysed them separately. In Table I are given the average results obtained in all the plots of the first series, and in Table II those of the second.

These remarkable results show that while the Tuc. 1406, planted alone, gave reasonably good yields, when planted in the same row with the other canes, it was entirely dominated by them, and produced very little cane per row, especially in the second series. Although when planted with POJ 2725 the proportion of the total yield due to Tuc. 1406 increased somewhat in the stubble year, in the plantings with the other varieties it definitely decreased. This extreme lack of compatibility between Tuc. 1406

Table I

Plantation of one continuous line of Tuc. 1406 and of one of another variety, in the same row*

Results of two annual harvests (Plant cane and 1st stubble)

	Plant cane		1st stubble		Average of the two years		
Variety	Kilos per row	% of total	Kilos per row	% of total	Kilos per row	% of total	Factory yield %
Tuc. 1406	237	13·5	415	23·8	326	18·6	9·64
POJ 2725	1513	86·5	1331	76·2	1422	81.4	8·55
TOTAL	1750	—	1746	—	1748	—	—
Tuc. 1406	166	9·2	63	3·9	115	6·7	8·73
Tuc. 1149	1631	90·8	1565	96·1	1598	93·3	8·33
TOTAL	1797	—	1628	—	1713	—	—
Tuc. 1406	240	14·2	215	12·3	228	13·2	9·02
Tuc. 2683	1453	85·8	1534	87·7	1494	86·8	8·98
TOTAL	1693	—	1749	—	1722	—	—
Check plot: Tuc. 1406 planted alone, two lines to the row							
Tuc. 1406	838	—	1193	—	1016	—	10·03

Table II

Plantation of one continuous line of Tuc. 1406 between two of another variety, in the same row

Results of two annual harvests (Plant cane and 1st stubble)

	Plant cane		1st stubble		Average of the two years		
Variety	Kilos per row	% of total	Kilos per row	% of total	Kilos per row	% of total	Factory yield %
Tuc. 1406	115	6·5	171	10·9	143	8·6	9·38
POJ 2725	1663	93·5	1395	89·1	1529	91·4	7·71
TOTAL	1778	—	1566	—	1672	—	—
Tuc. 1406	136	7·2	52	3·9	94	5·9	8·34
Tuc. 1149	1742	92·8	1278	96·1	1510	94·1	8·82
TOTAL	1878	—	1330	—	1604	—	—
Tuc. 1406	64	3·5	45	2·6	55	3·1	8·52
Tuc. 2683	1748	96·5	1705	97·4	1727	96·9	9·29
TOTAL	1812	—	1750	—	1782	—	—
Check plot: Tuc. 1406 planted alone, three lines to the row							
Tuc. 1406	1332	—	1201	—	1267	—	9·99

and the other canes is in marked contrast to the harmonious co-existence of POJ 36 and POJ 213 shown in the previous experiment.

In view of these results it was thought worth while to make similar experiments with some other varieties cultivated commercially on a large scale in this country, i.e. Co. 421, Tuc. 1149, Tuc. 2645, Tuc. 2680, and Tuc. 2683. To this end several large plots were employed. In each one, a sub-plot consisting of a number of rows of each of these varieties was planted, using two running stalks in each row, and in other sub-plots "mixed" plantings were made of two of the varieties, placing one running stalk of each in each row. To prevent the canes of any sub-plot from having any influence on those of the adjacent ones all the sub-plots were separated one from the other by a distance of eleven feet. The different sub-plots were all cultivated in exactly the same way, and harvested at the same time, the experiments being carried on until the third year stubble. Unfortunately, through labour difficulties, we were unable to obtain the production data per row in the harvest of the plant cane, but in the three stubble years the cropping was done normally, and, as in the previous experiments, we separated the stalks of the different canes, and counted, weighed, and analysed them separately. The average results from the different sub-plots obtained in these three harvests are given in Table III.

Studying these results, we see that when cultivated alone, each of the five varieties included in this experiment gave satisfactory yields of cane per row, Co. 421 and the Tuc. 2683 being the most productive. But when cultivated in "mixed" plantings, in most cases one of the canes entirely dominated the other, the proportion of the total weight of cane produced by the weaker variety being less and less from one year to another. In this way, Co. 421 progressively dominated the Tuc. 2680 and Tuc. 2683, and also, in an extreme degree, Tuc. 2645, which as third year stubble was reduced to giving only 6% of the total. The same thing happened with Tuc. 1149 planted with Tuc. 2645, Tuc. 2680 and Tuc. 2683—and also with Tuc. 2680 planted with Tuc. 2683. On the other hand, when Tuc. 2645 was grown with Tuc. 2680 and with Tuc. 2683, while it gave by far a less prop-

* In all the experiments described in this paper the rows were 100 metres long.

Table III

Plantation of one continuous line of each of two different varieties in the same row

Results of three annual harvests

	1st stubble		*2nd stubble*		*3rd stubble*		*Average of three years*		
Variety	*Kilos per row*	*% of total*	*Kilos per row*	*% of total*	*Kilos per row*	*% of total*	*Kilos per row*	*% of total*	*Factory yield %*
Co. 421	1049	64	868	54	730	51	882	57	6·39
Tuc. 1149	592	36	737	46	696	49	675	43	6·60
TOTAL	1641	—	1605	—	1426	—	1557	—	—
Co. 421	1713	90	1435	89	1230	94	1459	91	5.91
Tuc. 2645	184	10	169	11	75	6	143	9	5·97
TOTAL	1897	—	1604	—	1305	—	1602	—	—
Co. 421	1444	78	1412	80	1220	82	1359	80	5·15
Tuc. 2680	418	22	363	20	267	18	349	20	5·86
TOTAL	1862	—	1775	—	1487	—	1708	—	—
Co. 421	1502	78	1535	80	1259	88	1432	82	6·17
Tuc. 2683	414	22	375	20	174	12	321	18	5·37
TOTAL	1916	—	1910	—	1433	—	1753	—	—
Tuc. 1149	986	68	1033	70	998	81	1006	72	7·66
Tuc. 2645	456	32	451	30	239	19	382	28	6·88
TOTAL	1442	—	1484	—	1237	—	1388	—	—
Tuc. 1149	749	55	956	71	895	78	867	68	7·81
Tuc. 2680	609	45	384	29	256	22	416	32	6·67
TOTAL	1358	—	1340	—	1151	—	1283	—	—
Tuc. 1149	964	59	1117	77	1151	84	1077	73	7·72
Tuc. 2683	673	41	336	23	211	16	407	27	6·85
TOTAL	1637	—	1453	—	1362	—	1484	—	—
Tuc. 2645	528	27	424	35	267	33	406	31	7·47
Tuc. 2680	1404	73	798	65	541	67	914	69	6·76
TOTAL	1932	—	1222	—	808	—	1320	—	—
Tuc. 2645	348	20	293	28	201	34	281	25	7·18
Tuc. 2683	1350	80	739	72	393	66	827	75	6·32
TOTAL	1698	—	1032	—	594	—	1108	—	—
Tuc. 2680	1036	65	892	70	968	91	965	73	6·96
Tuc. 2683	559	35	386	30	98	9	348	27	6·56
TOTAL	1595	—	1278	—	1066	—	1313	—	—
	Check plots: Varieties planted alone, two lines to the row								
Co. 421	2288	—	2007	—	1745	—	2013	—	5·82
Tuc. 1149	1230	—	1331	—	1234	—	1265	—	7·06
Tuc. 2645	1465	—	1109	—	625	—	1066	—	7·69
Tuc. 2680	1782	—	1283	—	966	—	1324	—	7·29
Tuc. 2683	1921	—	2189	—	1152	—	1754	—	6·82

ortion of the total cane produced than did these varieties, it yielded relatively more in the second and third year stubbles than in the first. The only two canes which appeared to associate well with each other were Co. 421 and Tuc. 1149, in the "mixed" plantings of which each of them, when third year stubble, contributed half of the total weight of the production per row.

It is interesting to observe that while of the two dominating varieties Co. 421 yielded definitely more cane per row when planted alone than that produced by the "mixed" plantings with this variety, and also more cane than did the other varieties grown alone, this did not apply to Tuc. 1149, since in the "mixed" plantings of this cane with the varieties it dominated, more cane was obtained per row than that produced by the Tuc. 1149 planted alone, which also was definitely less than the average yields of Tuc. 2680 and Tuc. 2683 grown alone. Tuc. 2680, which in the "mixed" plantings with the Tuc. 2683 yielded much more cane than this variety (which as third year stubble was reduced to giving only 9% of the whole production per row), was definitely the less productive variety when the two were planted alone.

Tuc. 1149, both when grown alone and in the "mixed" plantings with other varieties, far from suffering a decline in its production from year to year, actually yielded more cane per row as third year stubble than as first. With the other canes on the other hand the production in the last year was definitely less than in the first, this being especially noticeable in the plantings of Tuc. 2645, Tuc. 2680, and Tuc. 2683, both when grown alone and with other varieties—with the exception of Tuc. 2680 grown with Tuc. 2683, of which the yields showed but little decline.

Reviewing all the experiments from the point of view of the factory yields, we observe that those of Tuc. 1406 (Tables I and II) were higher when this cane was planted alone, than in the "mixed" plantings, and that this also was the case with Tuc. 2645, Tuc. 2680 and Tuc. 2683 (Table III), except when the latter cane was grown with Tuc. 1149, when the factory yield was practically the same as when it was planted alone. On the other hand Co. 421 was richer in sugar in the "mixed" plantings (except with Tuc. 2680) than when grown alone. With Tuc. 1149 the factory yields were higher when it was planted with Tuc. 2645, Tuc. 2680, and Tuc. 2683 than when grown by itself, but were lower in the "mixed" plantings with Co. 421.

AGRICULTURAL ABSTRACTS

The use of chemical fertilizers with sugar cane. D. ONTIVEROS H. *Bol. Azuc. Mex.*, 1962, (157), 5–11.—The major part of the article consists in recounting the regional distribution and consumption of the N,P,K fertilizers in 1957–58. These are set forth in numerous tabular statements.

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Fertilization of sugar cane. A. GONZALEZ G. *Bol. Azuc. Mex.*, 1962, (157), 12–17.—Based on soil analysis, soils are divided with regard to the three major plant nutrients into three zones: of supply, adequate, doubtful and deficient, and recommendations are given for dressings according to the extent of the adequacy or deficiency.

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Study of the behaviour of different herbicides. H. D. DE SOUZA and A. A. PEIXOTO. *Brasil Açuc.*, 1961, **58**, (5 & 6), 27–31.—A brief record is given of the results obtained with five herbicides.

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New varieties of sugar cane and summer planting. K. NAGANO. *Nogyo oyobi Engei* [*Agric. & Hort.*], 1958, **33**, 1233-36; through *Plant Breeding Abs.*, 1962, **32**, 5116.—Trials of recently introduced varieties from Indonesia, India, Taiwan and the U.S.A. in southern Japan are reported, information being given on yield and sugar production.

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Problems in breeding and cytology of sugar cane. V. Chromosome increase in *Saccharum* hybrids in relation to interspecific and intergeneric hybrids in other genera. G. BREMER. *Euphytica* (Wageningen), 1962, **11**, 65–80; through *Plant Breeding Abs.*, 1962, **32**, 5119.—Various examples are cited illustrating the author's view that in *Saccharum* crosses, increases in chromosome number attributable to the female parent may be interpreted as being the result of partial or complete endoduplication occurring in the dyad or tetrad nuclei during megasporogenesis, whether followed by fertilization or pseudogamy; meiosis itself, or at least the first meiotic division, takes place normally. It is suggested that increases in chromosome number during interspecific hybridization in other genera may in some instances be explicable on the same basis, rather than on that of the nonreduction of gametes.

"Sterameal" planting mixture—a new manure for sugar cane. R. L. BHOJ and A. K. SHARMA. *Indian Sugar*, 1962, **12**, 115–116.—On the basis of comparative cost, "Sterameal" proved more profitable than ground-nut cake.

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Release and prospects of sugar cane varieties raised in Taiwan. C.-S. LOH. (LO). *Chung-hua Nung-hsueh Hui Pao* [*J. Agric. Assoc. China*], 1961, **33**, 18–33; through *Plant Breeding Abs.*, 1962, **32**, 5120.—Information is provided on the origin and agronomic characters of the following varieties released in recent years: F141, F144, F146, F147, F148 and F149.

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Accumulation and transformation of sugars in sugar cane stalks: mechanism of inversion of sucrose in the inner space. K. T. GLASZIOU. *Nature*, 1962, **193**, 1100.—Most of the invertase activity found in crushed pith cells from immature internodes occurred in the juice fraction. The activity disappeared in more mature internodes. No sucrose was synthesized from fructose during hydrolysis.

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Improved cultivation in Uttar Pradesh. KIRTI KAR. *Indian Sugar*, 1962, **12**, 338–344.—The increase in the Provincial yield of sugar is due to the increased acreage, for the yield of cane per acre remains constant around 420 mds/acre (15 tons/acre). Yet yields up to 2000 mds (73 tons/acre) or more in particular cases have been obtained. A cultivation schedule is laid down in an attempt to improve the position.

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Outbreak of leaf-sucking insects in Swaziland. J. DICK. *S. African Sugar J.*, 1962, **46**, 869.—The outbreak has occurred on the newly established Tambankulu Estate of some 1000 acres of cane grown under a well designed overhead irrigation system. The first symptoms appeared in late 1961 and spread rapidly. The cause was found to be the Fulguroid insect *Numicia viridis*. The insect and the symptoms are described, and protective measures are suggested as far as worked out in view of the rapidity of the attack.

SUGAR CANE AGRICULTURE IN JAMAICA

Annual Report, Research Department, The Sugar Manufacturers' Association Ltd., 1960.

A RECORD yield of 418,342 tons of sugar was recorded in spite of poor quality juice and, consequently, a record yield of cane over 500,000 tons above the 1959 record. This was attained partly by a 7% increase in acreage over 1959 but also by a record average yield per acre of 35·8 tons.

Cultivation

1. *Land preparation:* Where a hard pan forms, deep ploughing or sub-soiling are effective provided penetration is sufficiently deep to shatter the pan. Certain Jamaican soils, however, never dry out sufficiently to shatter. Under these wet, heavy clay conditions, 6 harrowings are shown to be as efficient as any other treatment.

2. *Trash burning:* Comparisons covering 2 ratoons are drawn between trash incorporated before planting, burnt prior to planting only, and burnt every crop. The second system gave the better yield in plant cane and, in diminished amount, in 1st ratoons, but this gain is equalled with an additional application of 1·5 cwt sulphate of ammonia.

3. *Effect of infield transport:* Both tractors and bullock carts passing over beds are shown to cause no reduction in yield compared with beds carrying no transport but additional cultivation is required.

4. *Standard of harvesting operations:* In a comparison between two estates, one removing 0·5 joints and the second 3·5 joints, the latter gave an increase of 0·7 tons sugar/tons cane.

Nutrition

1. Figures from five estates are given of the amount of P_2O_5 and K_2O removed in the cane crop. These range from 17·7 to 42·1 lb P_2O_5 and from 77 to 160 lb K_2O per acre.

2. A richly tabulated statement, covering the results of a foliar survey of 2,700 fields, is given. From this a fertilizer policy for each estate is prepared. Comparative curves are given illustrating the different values prior to and after rain.

3. The results of the aerial application of N are reported as disappointing, only giving an 80% yield compared with sulphate of ammonia in equivalent amount. A 5% aqueous solution of KCl at 12 lb/acre, sprayed on 2 month-old cane, raised the leaf K by 12% after 5 weeks, a difference which had disappeared at 12 weeks.

4. The results of foliar application for the improvement of quality were negative and a possible explanation given is the irregularity of irrigation water distribution.

Varieties

1. *Distribution:* The position as regards area of estate cane reaped (57% of total acreage) is substantially that of the previous year, with B 41227, B 44231 and B 4362 forming 82% of the total acreage. But there are considerable regional differences. The % acreage of old canes is 36, of all planted canes 4 and of spring planted 14.

2. *Comparison of varieties:* Varietal comparisons are given in tabular form in great detail, as are the numerous trials of varieties of the B 51 series and later, while the major characteristics of the varieties of the B 49 series onwards are briefly recorded. A detailed account is also given of trials of later selections, including seedling selection.

Entomology

1. The two reports on the canefly (*Saccharosydne saccharivora*), prepared by F. D. BENNETT of the Commonwealth Institute of Biological Control, are summarized. "Malathion" and "Endrin" have been used effectively, but the risks of destroying the pest-parasite balance and of building up resistant races are emphasized.

2. Three experiments with "Chlordane" at 2 and 4 lb, sprayed before planting, as protection against soil micro-fauna, gave no significant results.

3. A small survey of borer damage, measured as % joint infestation, made in 1959, showed 7·9%, i.e. an increase of 174% on the last extensive survey in 1954, the figure then being 2·9%. In 1960, however, the infestation had fallen to 5·4%.

Besides the numerous tabular general statements included in the Report itself, an appendix of 85 pages containing further tabular statements accompanies the Report.

H. M.-L.

The spread of certain species of moth borers in Northern India. R. R. PANJE. *Indian Sugar*, 1962, **12**, 333–337. The theme of the paper is that the borer position is not static. The various species of borers are considered from this aspect and the systems of control so far tries are reviewed.

* * *

Biological control of insect pests. I. Control of moth borers through dipterous parasites. P. N. AVASTHY. *Indian Sugar*, 1962, **12**, 345–358.—In view of the small success attained in India in the control of moth borers by cultural and chemical means, a programme of biological control is envisaged. The paper gives a detailed and well-annotated account of the experiences obtained in other countries of such control.

* * *

Tensiometer for cane irrigation control. M. A. MASCARÓ. *Sugar y Azúcar*, 1962, **57**, (11), 34–35.—A detailed account is given of the "irrometer", widely used on Hawaiian estates to measure the moisture conditions in the cane field. Permanently embedded in the soil at root depth, it gives a continuous reading which can be charted daily and used as a guide to the irrigation programme.

DETERMINATION OF SUCROSE

in the impure products of the cane sugar manufacturing process by the action of boron salts

By JOSÉ A. LÓPEZ HERNÁNDEZ

Reprinted from Arch. Farm. Bioquím. (*Tucumán*), 1961, 9, (2), 125–144.

PART II

INTRODUCTION

Our investigations are founded on the property of boric acid and its salts of combining with polyhydroxylic compounds to form complexes. As VAN'T HOFF has shown[2], combination is possible only when the polyols have adjacent hydroxyl groups in *cis* position. The long series of studies by BÖESEKEN has also been mentioned; from these the basic conclusions used in our studies have been drawn:

(a) that boron forms complexes only with polyhydroxylic compounds with adjacent hydroxyls in *cis* position.

(b) that in the polyhydroxylic compounds with open chains this condition is not permanent owing to the possibility of the hydroxyls changing their position in space with respect to the carbon atom to which they are linked.

(c) that the hydroxyls in cyclic compounds are not able to pass easily from one side to another and that if two of them are in *cis* position they will combine easily with boron.

(d) that by reason of point (c) sucrose, raffinose and the methyl-glucosides do not form complexes with boron in spite of their large numbers of hydroxyls because no two exist adjacently in *cis* position, but are found in *trans* position with respect to the pentatomic ring of their molecules,

(e) that the reducing sugars form complexes with boron and that the degree of combination is different for the α- and β-isomers. For these isomers, the degree of combination is not constant and its value varies with mutarotation until it reaches a final value at equilibrium. It is thus established that mutarotation is a displacement of the hydroxyls from one side of the plane of the ring to the other,

(f) that the formation of complexes between polyhydroxylic compounds and boric acid or its salts manifests itself in the increase of conductivity of the acid and in the modification of the optical activity of the polyhydroxylic compound.

For a better illustration, values obtained by BÖESEKEN on the increase in conductivity of boric acid by addition of polyhydroxylic compounds are reproduced below. As will be seen, the compounds of the first group are included among those described under point (b) and do not increase the conductivity because they do not form a complex.

Substances of the second group produce a marked increase in conductivity by forming compounds with boron because the *cis* position of their two hydroxyls permits this. Substances of the third group do not produce any increase in conductivity of the boric acid since, in spite of their having several hydroxyls, in no case are two of them in *cis* position in the molecule. The values are for 0·5M boric acid solutions.

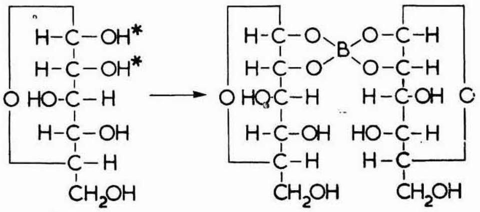
Compound	*Concentration*	*Increase in conductivity*
1,2-ethanediol	0·5M	—
1,2-propanediol	,,	—
1,3-propanediol	,,	—
1,4-butanediol	,,	—
pinacone	0·125M	—
glycerol	0·5M	+ 9
erythritol	,,	+ 64
pentaerythritol	,,	+ 72
mannitol	,,	+ 685
dulcitol	,,	+ 717
sorbitol	,,	+ 794
sucrose	,,	—
raffinose	,,	—
α-methylglucoside	,,	—
β-methylglucoside	,,	—

OBSERVATIONS AND RESULTS

Based on these proofs we started a series of studies intended to obtain a method for determining sucrose in a mixture with dextrose and levulose.

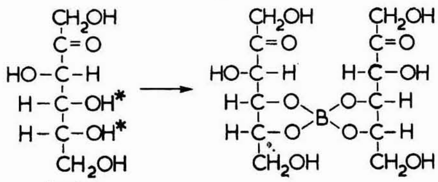
Our starting point was based on the fact the sucrose did not contain in its molecule two adjacent hydroxyls in *cis* position, could not combine with boric acid or its salts to form complex ions, and thus there was no modification either of conductivity or optical activity. On the other hand, dextrose and levulose, by having two adjacent hydroxyls in *cis* position, form complexes with boron and their optical activity is modified.

Examining the molecules of dextrose and levulose it is clearly seen how the boron combines with the adjacent hydroxyls in *cis* position (those marked with *).



dextrose

Fig. 1



levulose

Fig. 2

When the molecules of dextrose and levulose combine to form the sucrose molecule it has the following form:

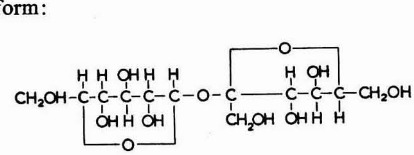


Fig. 3

As we see, of the adjacent pairs of hydroxyls in the dextrose and levulose before combination, one each has disappeared in forming the oxide link; consequently in the sucrose molecule adjacent hydroxyls in *cis* position no longer exist—the essential condition for boron to combine; this explains why boron does not alter the rotatory power of sucrose.

If a mixture of sucrose, dextrose and levulose is added to a boron salt, therefore, the dextrose and levulose will form boron complexes and their optical properties will be nullified, while the sucrose will not, so that the polarization of the mixture will be the same as that of the sucrose if it were alone.

The results of our determinations with pure sucrose, dextrose and levulose solutions and their mixtures, have enabled us to show that they comply with the principles mentioned above. Working with pure solutions of dextrose and levulose it is necessary to take into account the phenomenon of mutarotation which requires periodic repetition of polarimeter readings until a constant value is obtained, which sometimes takes a long time. It is possible to accelerate the mechanism of mutarotation by following the technique recommended elsewhere[17].

Working with pure sucrose solutions we observed that a small part appeared to combine with the boron salts and that there was a diminution in the polarimeter reading. Since we know that the boron combines only when there are two adjacent hydroxyls in *cis* position and these do not exist in the sucrose molecule, this leads us to conclude that the sucrose which we supposed pure is not so from the aspect of spacial chemical structure, since if combination with boron occurs there must be hydroxyls in the *cis* position.

This leads us to think that during the manufacturing process and crystallization there is a displacement of hydroxyls on a very small scale which takes place so that some take up the *cis* position and are able to combine with the boron.

This hypothesis is partially confirmed by the fact that this phenomenon is not observed except in solutions which contain sucrose provided by the dissolving of crystals. In products containing the same amount of sucrose—but sucrose which has never been in crystal form, as in the case of cane juice, syrup or molasses—this phenomenon does not occur.

It is also possible to suppose that in the crystal considered pure there exist addition compounds produced during the manufacturing process, as in the case of kestose, a trisaccharide the presence of which has been proved[18] and which has a positive rotatory power much greater than that of sucrose. If this trisaccharide has two hydroxyls in *cis* position, logically it will combine with boron and its positive polarization will be nullified while that of sucrose remains.

This special case of sucrose in the pure state led us to new studies to establish the origin of the abnormality. Fortunately the phenomenon, like the mutarotation of pure dextrose and levulose solutions, does not appear in the case of impure solutions which are the object of our work, since, as the results obtained with impure products from the cane sugar manufacturing process show, the values resulting from the method we propose differ very little from those obtained by the standard method.

From the experiments made with pure solutions of dextrose, levulose and sucrose we came to the conclusion that the deviation of the plane of polarization observed in the solutions of dextrose and levulose is annulled when the solution of boric acid or its salts is added; the rotatory power of the sucrose on the other hand is not modified.

We made numerous tests observing the action of boric acid and its principal salts on the rotatory power of dextrose, levulose and sucrose in order to determine the best result and to establish the suitable amount. We established that borax is the boron salt with the most marked effect in nullifying the rotatory power of the hexoses and we found that 25 ml of a 2% borax solution is sufficient to treat 100 ml of any sugar product.

(To be continued)

[17] A.O.A.C. Official Methods of Analysis. **9th Edn., 1960**, p. 422.

[18] DE WHALLEY: *I.S.J.*, 1951, **53**, 337; **1952, 54, 11, 127.**

ERIN FOODS

A Sugar Company's Expansion

The Company

THE achievements of the Irish Sugar Company, from the start, have been founded on vital contributions to its country's agriculture. On its establishment in 1933 the company bought an existing beet sugar factory at Carlow, Co. Carlow, and built three more at Mallow, Co. Cork; Thurles, Co. Tipperary; and Tuam, Co. Galway.

From the previous yearly figures of between 5000 and 13,000 acres, the sugar beet acreage rose to 44,000 in 1934, to 54,000 in 1935, to 58,000 in 1937. More and more farmers discovered the profitability of beet both in hard cash and as a rotation crop that improved their land and yielded food for their animals.

The company introduced contract farming on a wide scale for the first time. The farmer found he could get a guaranteed price and a guaranteed market, and that on signing the contract at the beginning of the season he would be given credit from the company to buy his seed and fertilizer. He could get skilled advice, too, and help with special problems.

For six years there was a gentle growth. The year 1939 brought the establishment by the company of a seed breeding station that was to make Irish beet unique for freedom from disease.

The beet acreage began to bounce upward—60,000 acres in 1940, a record 80,000 in 1945.

The heavy crops of the war years exhausted the soil, and the Company set up a soil-testing station. The soil needed lime, so the Company bought and developed two limestone rock quarries and took on the supply of ground limestone and factory lime (which includes plant nutrients) to farmers.

The farmer needed mechanical aid to harvest his beet. A variety of foreign-built beet harvesters were imported, only to fail in Ireland's small, hilly, often wet fields. An American engineer, Mr. Austin Armer, was called in. With one of the company's experts he designed the Armer Harvester to work in the most difficult Irish conditions.

But farmers were now doubtful of the value of any mechanical harvester. The company had to take a big chance; it manufactured 78 Armers, and organized the hiring of them to farmers, taking full responsibility for servicing, wear and tear—and disaster too.

Courage paid a dividend, and the farmers' confidence was restored while the company got valuable experience in the performance and servicing of the machines. A factory was established at Carlow and a development programme was started.

By the end of the 1953 manufacturing season more than 200 Mark III Armers were operating. And in 1958 the company introduced the simplified, lighter Mark V.

This machine proved to be so fast at the British beet-harvesting trials that it finished its plot of beet long before the other types of machine competing, and had to be given a second plot so that the public could see it working.

The respect of farmers outside Ireland was won; exports began to mount and the workshops at Carlow are kept at full stretch to cope with demand. A hiring and servicing organization has been set up in Britain. Continental users want the "Flying Irishman" too.

From the beginning of the 50's the Company has taken on more and more of the building and replacement of its own factory equipment, a big task in the running of a sugar plant which has continually to be renewed.

Many other types of agricultural machinery were produced, some built under patent, some designed and developed by the company's own experts.

The Company has also applied a far-sighted policy of establishing and maintaining goodwill in its relations with its farmer-suppliers and labour force.

In 1948 the company and the Beet Growers' Association jointly sponsored a successful full-scale, independent inquiry into the whole costing of sugar beet production, which established a clear, unchallengeable basis for the contract price which is fixed annually between company and growers.

A series of welfare schemes for the Company's employees has gone into operation which touches their lives at many points, yet leaves them independent. These include the building of estates of modern houses, insurance and pensions schemes, works committees, organized benevolent societies, holiday funds, fuel purchasing groups, adult education programmes, gardening guilds, sponsored courses in technological subjects and advanced studies in Dublin, a prize scheme for inventions and ideas, etc.

The Company has also played an important part in developing and encouraging reclamation of the bog land that had been previously considered hopeless.

The immediate aim was to provide more beet for the company's factory at Tuam where the supply had never been enough to employ the plant fully. The ultimate aim was to show that vast new stretches of Ireland could be turned into highly productive farming land, bringing new complexes of life to the barren western areas.

In 1951 the company bought 1000 acres of the Gowla bog, in the Tuam district, and a further 1400 acres the following year. Today its holding is 3400 acres.

Tractors, ploughs and other machinery were adapted for working on the bog, which was 95% water. Drains were cut, then gradually deepened.

As the months went by and the water level fell, the ground was dressed with lime, cultivated, fertilized, seeded with grass, and rolled. As the grass came up it was cut, dried and turned into valuable animal foods.

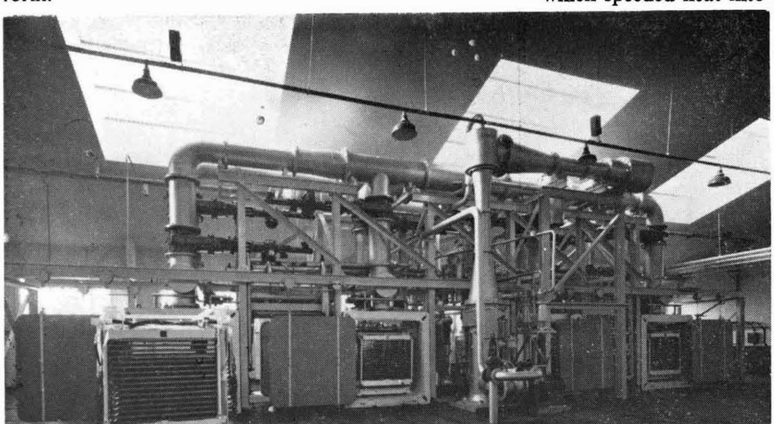
And as the years passed the ploughing and fertilizing went deeper and deeper. Finally, grass crops gave way to potatoes, wheat, barley, celery and carrots. A battle had been won, a battle of the greatest significance to Ireland and a hungry world.

Together, the people and the land were producing more food. The movement of that food to the markets, the shops and the tables was the next logical step in the development of the Irish Sugar Company.

In 1958 the company took the logical decision to process Irish-grown food, by the most advanced methods available, for marketing abroad. The Erin Foods Division was formed and a full-scale development programme was launched. The company's investment already runs into millions of pounds.

THE PROCESS

Preservation of food by the removal of water has been known for thousands of years. But these forms of crude dehydration produce food that, to say the least, does not taste the same as it did in its original form.



The world's first commercial-scale accelerated freeze-drying plant, set up at Mallow

Freeze-drying, which went into use between the wars for medical purposes, such as the preservation of blood plasma, was recognized by many people as the ideal method of preservation. For by removing the water in a frozen state the food would regain all its natural qualities when reconstituted.

But freeze-drying was slow and expensive and only tiny quantities of material could be treated at a time. The insurmountable barrier to a commercial-scale process for food, it seemed, was the technological problem of conveying heat into the frozen material, in a vacuum, so that the ice would vaporize, not melt.

A historical step forward was made during the war in Copenhagen where fish was dried by putting it on a hot plate in a vacuum, resting a second hot plate on it, and keeping both plates in contact with the fish as it shrank in drying.

This process, known as Vacuum Contact Drying or VCD, was so promising that when Britain opened its food processing research station at Aberdeen, Scotland, in 1951, equipment was bought from Copenhagen for experiment.

But advanced though this process was, the team of scientists and engineers who went to work at Aberdeen could not find the qualities of nutrition, flavour and speed of reconstitution they were seeking.

But after years of experiments they were rewarded with two major successes.

The first was an engineering development that brought down the pressure in the drying cabinet to the point where frozen food could be kept frozen, and the second was the use of expanded metal mesh, inserted between the food and the heating plates, which speeded heat into the food and vapour out.

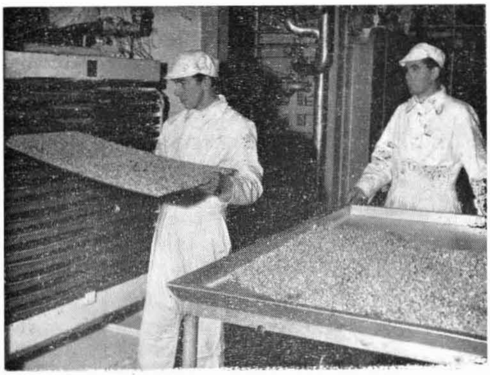
At last it had become possible to freeze-dry a ton of food in eight hours. But still much technological development and scientific research remained to improve the reliability, uniformity and economics of the system.

New advances were made. But by 1958 it was decided that the time had come for commerce to take over the risks and the rewards.

The Irish Sugar Company accepted this challenge. In January 1961, an AFD pilot plant was delivered to the company's base at Mallow, County Cork. Later in the year the main AFD plant at Mallow—the first commercial-scale AFD installation in the world—was completed, and a new chapter in AFD development began.

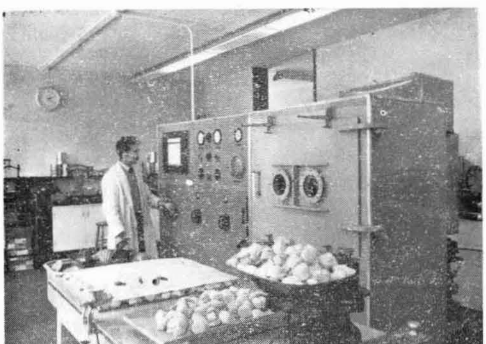
The company's field staff and scientists, some of them from the Aberdeen team, are experimenting in seed and variety for the choicest of fruit and vegetables, in the breeding and rearing of animals for the primest of meat and poultry, and in the harvesting of the finest sea foods.

Side by side with accelerated freeze-drying, the whole range of new food processing techniques was examined. Advanced methods of air drying, or AD, were found to be excellent and developed further. In July 1961 work began on a processing plant at Tuam, County Galway, geared to produce £450,000 worth of potato flakes a year. It was in production seven months later.



Unloading diced chicken from an AFD cabinet after processing

One of the most up-to-date food research and development laboratories was built in a few months at Carlow, County Carlow.



Scallops go through a test run at the Erin Foods research laboratories, which are equipped with a pilot AFD plant

Plans for a big new processing plant at Carlow were brought forward. The building was designed, constructed, equipped and staffed all within the first six months of 1962.

A central packing station was built at Thurles, County Tipperary, one year ahead of schedule. The Mallow AFD plant was expanded.

Co-operating closely with the Irish Agricultural Institute, research and development staffs worked out the whole chain of supply, from the right seed to the establishment of a fleet of radio-controlled cars to organize the harvesting and collection of crops at the peak of freshness.

In the company's new research laboratories and kitchens, chemists, chefs, home cookery experts and a panel of tasters have been turning the AFD and AD techniques into appetising, easily-prepared foods and recipe meals.

Where difficulties were found they were overcome; for instance, it was found that demand for mushrooms already exceeded supply so a mushroom-producing plant was launched at Thurles with an output of several tons per week.

The Foods

With January 1963 the first large-scale supply to the British market of foods treated by the revolutionary AFD process has now been launched. Initially it is confined to bulk buyers in the North West although orders from all over the United Kingdom can be met from the Liverpool office.

The first AFD foods offered are: beaf steaks, minced cooked beef, minced cooked pork, peas, French beans, escallops, Dublin Bay prawns, and a range of twelve soups—tomato, mushroom, celery, chicken noodle, kidney, thick vegetable, potato,

Some of the packs that have been developed for the sale of Erin AFD and AD foods in Ireland and the United Kingdom

Minestrone, beef noodle, oxtail, spring vegetable and golden onion.

Side by side with AFD products Erin is marketing peas, cabbage and diced carrots processed by the most advanced air drying (AD) methods. These AD techniques produce foods of high quality, with the easy-to-store, easy-to-use advantages of AFD foods but at a much lower price.

The company's HQ is at Clare Street, Dublin. Its other main bases are at:

Mallow, County Cork, site of the accelerated freeze-drying plant, a beet sugar factory, and an air-drying plant. The AFD plant processes five tons of food a day.

Carlow, County Carlow—Food processing plant; research and development laboratories; sugar manufacture; agricultural machinery manufacture.

Thurles, County Tipperary—Packaging station; experimental farm; mushroom production; plant breeding; sugar manufacture.

Tuam, County Galway—Potato processing (Erin Potato Flakes); sugar manufacture.

Ballybeg (near Mallow)—Ground limestone; concrete products.

Killough (near Thurles)—Ground limestone; limestone flour.

Gowla (near Tuam)—Fruit and vegetable growing; animal foods.

The General Manager of the Irish Sugar Company is Lieut-General M. J. COSTELLO. Head of the Erin Foods Division is Mr. JAMES L. GINNELL. Responsible to him are:

Mr. PAT. B. JONES, Marketing Officer.

Dr. SEAMUS MACGIOLLA RIOGH, Research and Development Officer.

Mr. C. G. TUCKER, Technical Advisor.

Mr. LOUIS O'SULLIVAN, Public Relations Officer.

The Irish Sugar Company has more than 3000 men and women on its payroll, a total which is greatly increased during the campaign period. More than 30,000 independent farmers supply the company.

Of the company's share capital 25% (the ordinary shares) are held by the Irish Government and 75% (preference and debenture) are held by the public. The company receives no state subsidies and finances its capital development from reserves (workmen's compensation, pension funds, etc.).

AUTOMATIC FILTRATION OF SECOND CARBONATATION JUICES

By R. HULPIAU

Raffinerie et Sucreries du Grand Pont, Gembloux, Belgium.

Paper presented to the 15th Tech. Conf., British Sugar Corportation Ltd., 1962.

INTRODUCTION

FOR three campaigns the Sugar Factory of Gembloux has used, with good results, entirely automatic 2nd carbonatation filters, conceived and built by the factory. The same filters have now been adopted by other factories.

In 1958 we installed continuous clarification and vacuum filtration, and began to think about a way to cut out second carbonatation filter presses. Some methods had already been tried, namely, settling (Roye) and hydrocyclones (Germany), but without much success.

Laboratory tests made during the 1958 campaign showed that the filtration coefficient F_k of the second carbonatation juice was always about five times better than that of 1st carbonatation juice, and it was thus logical to retain filtration if we wanted to utilize to the maximum the natural properties of the juice.

PRELIMINARY INVESTIGATIONS

We built a small test filter, with a filter area of 2·4 sq.m., having 4 frames of 600 × 500 mm, to make our own investigations.

At the beginning the results were not good, the quality of the cloth used having a great influence on the clarity and the flow rate.

After a lot of trials, evidence was found of the possibility of an industrial application under the following conditions:

1. The space between frames should be large enough to avoid bridging by cake.
2. The juice inlet and outlet should be large to minimize the reduction in flow rate.
3. Washing between operations should be strictly prohibited as it destroys the precoat on the cloth.
4. The filter should be dumped at regular intervals to avoid cake bridging between the frames.
5. The synthetic material filter cloth must be sufficiently thick.
6. The cloth support must be rigid enough to resist deformation and must always give a free flow of filtered liquid.

Filter Design

Following the above requirements we built three filters after the 1958 campaign (see Fig. 1). Their specification included:

- filtering area 34·5 sq.m., with 23 frames 760 × 1000 mm (see Fig. 2)
- maximum pressure 1·2 kg/sq.cm.
- maximum working pressure limited to 0·800 kg/sq.cm.
- cloth support—wire mesh of 12 mm thickness stainless steel, 1·25 mm wire.
- net capacity of filter 3,900 litres.

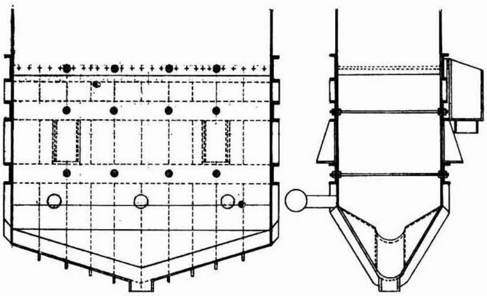


Fig. 1

In an appendix to the paper are given the figures of labour and cost of building and erecting the filters.

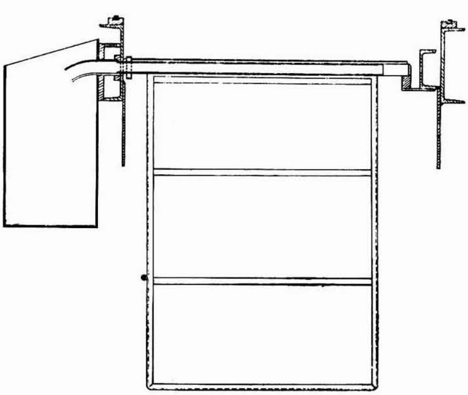


Fig. 2

Filter Operation

The filters are fed like ordinary gravity filters as indicated in the flow sheet (Fig. 3). At regular intervals and before cake can bridge between the frames, one filter is put out of operation (inlet valve closed) and the filter sludge is dumped (outlet valve open).

The inlet and outlet valves are Saunders 5-inch pneumatic valves.

Automatic controls takes care of all the openings and closings of the valves at a preset cycling time.

The details of operation are the following:

time		0	warning signal
		10 sec	inlet valve closes
		30 sec	outlet valve opens
	3 min	30 sec	outlet valve closes
	3 min	50 sec	inlet valve opens

The filter is out of service during the time the inlet valve is closed, i.e. for 3 min 40 sec in a total service time of 90 min, so the filter is running 96% of the time.

The sludge is sent to a mixing tank of sufficient capacity and then pumped just after preliming (to raw juice in factories without preliming) through a dosing pump to avoid disturbances in the juice levels.

Working Data

During the 1959 campaign we added 0·20% lime before second carbonatation.

Operating data of that campaign are as follows:

Draught before second filtration	121·13 % on beet		
Second liming	0·19% CaO		
Slicing rate per 24 hours..	2000 tons	2250 tons	2500 tons
Total volume of second carbonatation juice....	24,226 hl	27,254 hl	30,383 hl
CaO/24 hr	4583 kg	5178 kg	5754 kg
$CaCO_3$/24 hr............	8184 kg	9248 kg	10275 kg
$CaCO_3$ per filter per 24 hr	2728 kg	3083 kg	3425 kg
$CaCO_3$ per cycle (90 min)	171 kg	193 kg	214 kg
Rate of flow per hour....	100·9 cu.m.	113·6cu.m.	126·2cu.m.
Rate of flow per filter....	33·6 cu.m.	37·8 cu.m.	42·0 cu.m.
Litres/sq.m./hr	943	1080	1200
Concentration of mud ..	43·8 g/litre	49·0 g/litre	54·8 g/litre

The rates of flow given are far below the real capacity of the filters. Tests made at the end of the campaign give flow rates of 3000 litres sq.m./hr.

The filters worked the whole campaign (40 days) without any labour and without any stopping for washing.

The filtered liquid is perfectly clear, except at the start of the cycle, the filtrate being a little bit cloudy during the first 40 seconds.

During the 1960 campaign we worked without lime before second carbonatation. The cycles were extended to 180 min without any trouble.

Miscellaneous

We estimate that each filter can handle the juice of 1000 tons of beets per 24 hours. In an appendix are given the performances of the filters in the different factories where they are installed.

After three campaigns' operation and with the experience of the other users of this filter, what alterations in design should we make if we had to remake the filter? Very few in fact, and none to the shape of the filter or the frames.

We should only use all stainless steel for the frames to avoid maintenance after campaign. The tank itself would be lined with an anti-acid coating. The space above the frames should be as small as possible and we would also advise 6-inch rather than 5-inch outlet valves.

Concerning filter cloth, at Gembloux we tried different kinds of cloth, all of synthetic materials. The rates of flow varied from 1300 to 3000 litres/sq.m./hr, according to the condition and the nature of the cloth.

At the moment three types of cloth have been adopted: Lainière de Sclessin "Lainyl IX/C4/29", Struyven Tirlemont "3850 C R T L T", and Solana Anvers "Neotex—34 P.S. 2507" (newly tested).

Heat losses are very small provided the filter is well insulated and the outlet gutter is enclosed by a cover with an air orifice of only 200 mm.

Conclusion

We believe that we have built a filter which is perfectly capable of procuring automatic filtration of second carbonatation juices. It is of very simple design and can be easily built at the factory.

The filter gives very good filtration without any filter aid, and is also very economical in labour, in cloth consumption and in maintenance.

The Grand Pont filter has helped us to go one step further in labour saving and in the development of an automatically controlled continuous process which must be our aim for the future.

Appendix 1

Filter Costs

LABOUR

Building	
Plate work	948·00 man hours
Workshop	506·50 ,,
Frames	696·25 ,,
Covers	60·50 ,,
Piping with automatic valves	227·75 ,,
Other valves	30·50 ,,
Seals of filter	32·75 ,,
Painting	69·00 ,,
Handling filters	259·50 ,,
Handling frames	97·50 ,,
Erecting filters	638·50 ,,
Ancillary work	
Dismantling and transport of Kroog filters	576·00 ,,
Supporting floor	483·00 ,,
Floor (tiles)	226·00 ,,
Electricians	114·75 ,,
Miscellaneous	200·50 ,,
Mud tank	37·00 ,,
Piping	937·25 ,,
Controls	258·50 ,,
	6,437·75 man hours

TOTAL COST (Belgian francs)

	Material	*Labour*	*Total*
3 filters	93,510	120,700	214,214
Erecting and floor	31,500	64,000	95,500
Frames (69)	87,315	27,850	115,165
Mud tank	46,280	48,760	95,040
Automatic controls	113,435	11,340	124,775
Control Panel	11,270	—	11,270
Pipes and valves	31,900	55,740	87,640
			763,604 Belgian francs

Cost of one filter without frames: 71,405 Belgian francs (£510)
Weight of one filter without frames: 3,070 kg.

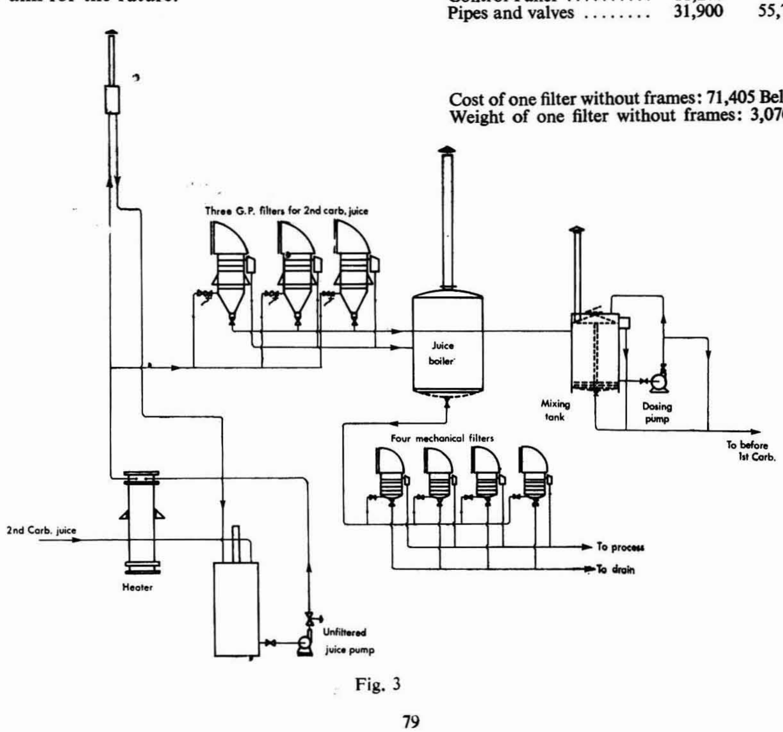


Fig. 3

Appendix 2

Filtration of second carbonatation juices

Installation	1	2	3	4	5
Number of filters in use	3	3	3	2	3
Filtering area (sq.m.)	3 × 34·5	3 × 30	3 × 34·5	2 × 34·5	1 × 45 + 2 × 35
Inlet Juice					
°Brix	14	12·5 – 13	15·97	14·5	13·25
Temperature (°C)	90°	85 – 95°	92°	92°	95°
Nature of juice	no lime	no lime	no lime	no lime	no lime
Working pressure (kg/sq.cm.)	0·400	0·350	<0·200	0·800	0·200
Filtered Juice					
Clarity	excellent	excellent	excellent	not recorded	excellent
Flow rate (litres/sq.m./hr.)	1200	1500	880 to 2600	1970	1300
Time cycle	1½ hr	3½ hr	1½ – 2½ hr	1 hr	8 hr
Filter cloth					
Type	"Lainyl" "Struyven" "Neotex"	"Lainyl"	"Struyven" "Lainyl"	Cotton 16 oz/sq.yd.	"Lainyl"
Cloth usage (changes)	4 times in campaign	none	changed weekly	changed weekly	—
Life of cloth	1 campaign	2 campaigns	1 campaign	1 campaign	1 campaign
Where dumped	After preliming	After preliming	Before vacuum filter	Raw Juice	Preliming
Operating labour	Common with thick juice	none	none	none	none
Maintenance cost off-season	250 hours (painting frames)	—	not recorded	not recorded	—

THE DRYING OF WHITE SUGAR

and its Effect on Bulk Handling

By T. RODGERS, B.Sc., D.R.C.S.T., A.M.I.Chem.E. and C. LEWIS

Paper presented to the 15th Technical Conference, British Sugar Corporation Ltd.

PART IV

Theory of Moisture Distribution on White Sugar Crystals

We stated earlier in the paper that one of the aims in our investigations was to try to determine in what form moisture was present in sugar, so that we may better decide how it can be removed. From the results obtained, and from the work of other investigators, among whom the name of H. E. C. Powers[3] of Tate & Lyle is obviously outstanding, we put forward the following suggestions which at the moment seem to fit the facts. It is not within the scope of this paper to explain the theory in terms of the physical chemistry involved, and we do not attempt to do so. It seems that all wet white sugar going from centrifugals to the factory drying plant has moisture present which may for convenience—in analysing the "dryability" of the sugar—be assumed to be present in three different physical form:

(1) what we shall call Free Moisture. All the individual crystals coming from the centrifugals are surrounded by a more or less dilute sugar solution. A very large proportion of the moisture present in this film is relatively easily and quickly removed in the conventional type of driers.

(2) what we shall call Bound Moisture. This is moisture on the surface of the crystal which is comparatively difficult to remove, and is only done so by maintaining the sugar under reasonably dry conditions for a comparatively long time—i.e. the so-called "sugar conditioning." To get an explanation of its presence, it is necessary to consider the crystal after the removal of the Free Moisture. It is then surrounded by a comparatively highly concentrated—indeed highly supersaturated—syrup film. But the relatively fierce drying conditions still exist, and the sucrose molecules in the film cannot place themselves into the crystal structure at a rate fast enough to keep pace with the attempted evaporation of moisture. As a result this sucrose crystallizes in the form which Powers has so well illustrated and described in his fascinating work on the subject of crystallization in thin films at high degrees of supersaturation. It is in fact partly an amorphous[4] sucrose, partly a fondant-like layer. In any case water is trapped in this layer, and is only released gradually as the molecules of amorphous sucrose re-orient themselves on to the crystal structure. This is a slow process, the speed being controlled by a crystallization rate in a concentrated solution.

(3) what we shall call Inherent Moisture. By this we refer to pockets of moisture (i.e. sugar solution)

[3] Powers: *I.S.J.*, 1956, **58**, 246; *B.S.C. Tech. Conf.*, 1958, 1960, 1961; *Rpt. Hawaiian Sugar Tech.*, 1960, 113, 135, 143; Principles of Sugar Technology, Vol. II. Ed. P. Honig. (Elsevier, Amsterdam). Chap. 1.

[4] Palmer *et al.*: *J. Agric. Food Chem.*, 1956, **58**, 77.

actually trapped completely within the sucrose crystal. POWERS has again given this aspect considerable study, and also mentioned the large increase in moisture when grinding sugar, a phenomenon also recorded by HIBBERT at B.S.C. Central Laboratory. The reason for this is extremely complicated in the realms of crystallography and is probably bound up with the different crystallization rates on the various faces of one crystal, and to the varying degrees of saturation through which a single crystal passes in its excursions up and down and around in a vacuum pan. There is also the effect of other impurities in the mother syrup, and the so-called "sleeve of contact" suggested by POWERS. We have not investigated this form quantitatively in this work but hope to do so in supsequent investigations.

MOISTURE REMOVAL FROM WHITE SUGAR

Free Moisture

In considering drying sugar received from the centrifugals we must think first of all about the removal of Free Moisture. In this respect an investigation has been carried out on sugar drying plant during the past two years by R. J. WITHERS and his assistants of our Central Offices. This has been done mainly at Brigg, with some preliminary work at King's Lynn, Cantley, Spalding and Kidderminster. We are indebted therefore to WITHERS who has supplied us with all the following information on factory granulators in order that this investigation may be more comprehensive.

Without recording all the large amount of information gathered, suffice it to say that the technique was to measure the air temperatures and humidities inside and outside the granulator, also sugar flow and air flow. Measurements were also made of the temperatures and moistures of sugar entering and leaving the granulator, and sufficient data were obtained for cross-checking by means of heat and mass balances. On a large number of samples taken to measure the sugar moisture entering the granulator, the great variability of this factor was noticed, and as this has a very important bearing on the drying rate, it is obvious that any means of producing more uniform results in the moisture content of sugar from the centrifugals will be a great advantage in removing Free Moisture.

WITHERS also finds that the drying rate is a function of the relative humidity of the air, which he suggests should at least be maintained under 50%. Under normal working conditions this is not difficult, nor is the inlet air humidity critical, since the air is substantially heated in contra-flow by the sugar. Finally, he concludes that with a residence time of 6–10 minutes (dependent on inlet moisture), keeping the outgoing R.H. at 45%, that the sugar will have an apparent (3 hr) moisture content in the region of 0·02%–0·04% dependent on the sugar quality, and this is about all the moisture one can expect to remove in these conditions. As he points out, the normal factory granulator is intended to deal only with this type of moisture, which evaporates off very readily purely on a basis of vapour pressure differences.

From a study of a number of works presented in technical journals referring to the drying of granular solids in counter current drum driers, the results obtained by Withers fitted best the work of SAEMAN & MITCHELL[5]. In this work the following formula was quoted: $T = \dfrac{L}{\pi\, D\, R\, n\, (S - mv)}$, where T = retention time (min), L = length of drier (feet), D = diameter of drier (feet), R = rotation rate (r.p.m.), S = slope of drier to horizontal (radians), v = air velocity (ft/min), n = constant = $\dfrac{1}{1{\cdot}64}$, and m = constant = 0·00015. The constant n is characteristic of the drier design, being dependent on the number of flights and their design. With the tests carried out the above value was determined. The constant m is dependent mainly on the characteristics of the material being dried. For our normal granulated sugar, the value 0·00015 was obtained.

From the above equation, and making the following assumptions which we have enumerated earlier from the findings of WITHERS, it is possible to produce a graph from which a granulator specification may be read off. The following are the values of the variables assumed and the specification shown on Fig. 11:—(1) From each 100 lb of sugar, 0·8 lb of water has to be removed. (2) Exit air taken at 100°F and 45% Relative Humidity. (3) Inlet air absolute humidity is 5 grains/cu.ft. (4) Retention time of 10 minutes. (5) Air velocity 200 ft/min.

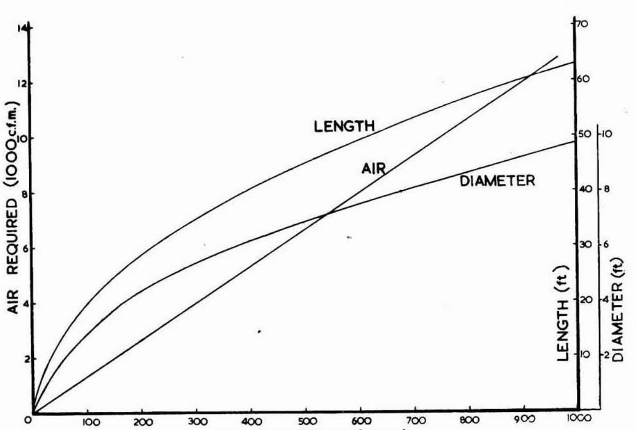


Fig. 11

[5] *Chem. Eng. Prog.*, 1954, 467–475.

The final value has been determined in practice to avoid excessive carry over of sugar.

If we examine Fig. 11 for any given quantity of sugar to be dried, the air volume required may be calculated from the total water to be removed and items (2) and (3) above. Having made this plot, which is a straight line, the diameter may be calculated using the total air volume and the air velocity of 200 ft/min. In this instance a percentage loading of 10 is taken, i.e. the area of the charge to the total cylinder cross section (or vol. of charge/vol. of cylinder). Finally, using the formula already quoted, the length of the drier may now be calculated if we have values for R and S. These have been assumed from our practice at 7 r.p.m. and slope of 4½° to the horizontal.

Bound Moisture

In our opinion, this form of moisture is the greatest enemy to bulk handling. It is always present to some extent following the conventional rapid drying process to remove surplus moisture. It is also inevitable that this bound moisture will be released continually and relatively slowly after granulation, and will go into the surrounding atmosphere raising the humidity until a new equilibrium is set up. This can mean excessive moistures on the sugar. To avoid the latter, it is necessary to remove the moisture as it is released, but this means large plant and conditioning equipment because of the slow release.

It is apparent that if one can speed up the release of this bound moisture, one can reduce the size and cost of conditioning plant. This has been in our minds during the investigations, but in fact we do not consider we have yet sufficient evidence to reach any definite conclusions. More work is necessary and it involves a good deal of care to eliminate the effects of crystal shape. Present evidence suggests that the relative humidity of the air in the conditioning plant is not an important factor (so long as it is maintained under say 60%). What may be more important is the temperature of conditioning. There is certain evidence that the higher temperature—within practical working limits—increases the release rate, or decreases conditioning time. At Allscott factory, WITHERS reports finding a definite and appreciable increase in release rate when the sugar entered the conditioning bins at 32°C instead of approx. 23°C. This was ascertained by measuring the moisture pick-up in the air—to obviate errors in sugar sampling. The reservation must be made however, that the duration of tests was very short because of the lateness in commissioning the plant. Also, if we refer to Fig. 1, after 25 hours the total moisture released from stirrer pan samples 1, 2 and 3 is less than the other tests at the higher temperatures. It is realized of course that many other factors affect these results, and certainly one could not base any conclusions on this. This question of optimum conditioning temperature is certainly one which requires a thorough investigation on both laboratory and factory scale.

If moisture release rate increased with temperature, the practical benefits would be not only a reduction in size of the conditioning bins, but also in the expensive air drying and refrigeration plant. Assuming conditioning was to take place at 40°C, simply heating (and filtering) ambient air would give a sufficiently low relative humidity, and provided heat losses in the bins were minimized by insulation, the freed moisture could be satisfactorily carried away. It would, of course, be necessary to cool the sugar finally in some manner before bulk storage or despatch.

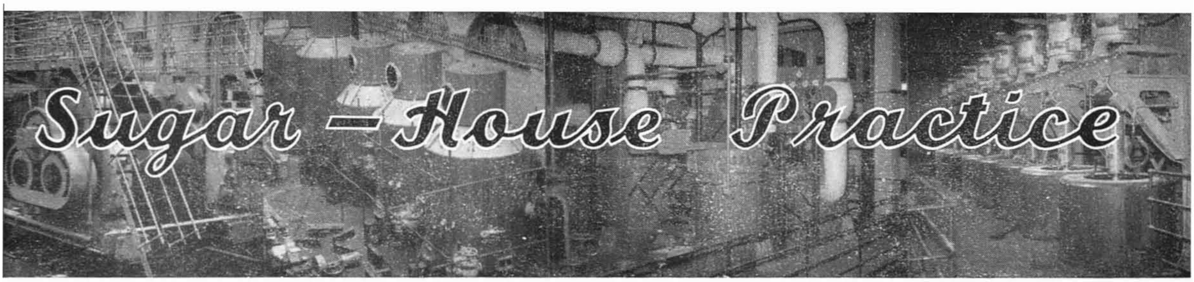
The authors would however suggest another way of tackling this problem of Bound Moisture, and by a method which is also generally beneficial to the quality of the sugar. We refer to the results achieved with the sugar produced in the pan fitted with a mechanical circulator. It has been shown by HIBBERT[2] and others[1], that the greatest proportion of ash in a white sugar is on the crystal surface. The fact that we appreciably reduced the % ash with the circulator sugar, together with a visual comparison between this sugar and one produced by normal technique, makes it apparent that the amount of syrup on the surface of a well formed crystal is considerably less than on a conglomerate. The achievement of forced circulation is therefore to produce a comparatively conglomerate-free sugar, hence reducing the proportion of syrup on the crystal, with the result that the amount of moisture bound on this "too rapidly dried layer" is appreciably reduced. It does not however completely eliminate Bound Moisture, but it reduces it so much that conditioning plant may be unnecessary, and certainly will be much reduced in capacity.

The mechanical circulation is thus the suggested means to the end—conglomerate-free sugar. It is true, of course, that other techniques used in sugar boiling will minimize conglomerate formation—although on samples examined we have not seen a sugar so good in this respect as that produced by mechanical circulation. In addition, these techniques e.g. boiling "hot" (reduced vacuum) use of water to aid circulation, low density liquor, etc., all have certain other process disadvantages. The practical disadvantage with the Circulator—apart from the capital depreciation on a not too expensive installation—is the extra power consumed. At the same time, it can increase vacuum pan capacity, and in our industry at least, the cost of the additional power involved is negligible.

Inherent Moisture

We have carried out no tests on this moisture which is actually trapped within the crystal, but have mentioned it here only to complete the picture as we see it, because there is overwhelming evidence of its existence. H. E. C. POWERS of Tate & Lyle is probably the most advanced world authority on this particular subject. It is our intention to make some quantitative determinations of Inherent Moisture next campaign, especially as we believe that again

(*Continued on page 83*)



The by-product power of the sugar industry. H. S. Wu. *Taiwan Sugar*, 1961, **8**, (12), 13–15.—By increasing live steam pressure from 150 to 900 p.s.i.g., a 2000-ton cane sugar factory can generate 4000 kW more electricity for sale, while more than 3000 kW surplus can be generated with an increase to only 600 p.s.i.g. Economics of such power production are briefly estimated.

* * *

Testing and evaluation of continuous centrifugal separators. H. M. Liaw, C. H. Yen, C. H. Chen, S. L. Sang and J. C. Kao. *Taiwan Sugar Quarterly*, 1962, **9**, (1), 20–24.—Examination of a Hein,Lehmann continuous centrifugal working on *C*-sugar showed that with 0·15 × 1·70 mm screens, fine crystals passed into the final molasses, increasing its purity. Screens of 0·06 × 0·85 mm gave lower purity molasses but were too thin and cracked quickly. The best screens found were of 0·09 × 1·68 mm (0·23 mm thick) and 0·08 × 1·15 mm (0·14 mm thick) which allowed a throughput of 3 tons of massecuite per hour (about $3\frac{1}{3}$ times that of a batch machine) and sugar pol of 86 without crystal loss. Water washing improved the sugar pol but also raised molasses purity, while steam washing was worse in this regard. Washing with diluted (70°Bx) final molasses (7–12% by volume of massecuite) gave satisfactory purging capacity and superior sugar. *C*-sugar produced and double-cured using a continuous centrifugal could be used directly as *A*-sugar seed, giving good quality raw sugar (97·85 pol, 0·50 moisture and 75·27 filtrability). Power required is 2·67 kWh per ton of *C*-massecuite compared with 8 kWh/ton for a batch machine.

* * *

Mill sanitation—a comparative study. S. I. Wang, K. L. Chang and C. W. Chen. *Taiwan Sugar Quarterly*, 1962, **9**, (1), 32–35.—Examination of mixed juice at Chekan showed that it lost 0·09% of its pol content after standing for 15 min. Mill sanitation with milk-of-lime has a negligible effect, but continuous slow addition of chlorine water (3·5 g Cl_2/litre) to juice reduced the pol drop to 0·013%. The chlorine suppresses the activity of some micro-organisms and also kills some. Its use offers a calculated potential saving of NT$130,190 per year for a 1650-ton factory crushing during a 120-day season.

* * *

Factory scale trial of middle juice carbonatation process[1]. J. D. Taneja, S. C. Sharma, S. P. Seth and Staff. *Indian Sugar*, 1962, **12**, 221–222.—Factory and laboratory tests in which 15% milk-of-lime (by volume) was added to 32·5°Bx juice (at 90–95°C and already limed to pH 7–7·1) together with gassing to give a 1st carbonatation end-point of pH 9·9–10 are described. Filtration was easy, with satisfactory formation of cake of good sweetening-off qualities. Wide fluctuations in the pol % mud were caused by inefficient sweetening-off. The purity rise from middle to clear juice varied from 3·8 to 4·6 units. Because of evaporation difficulties, the tests are to be repeated.

* * *

The storage and pneumatic conveying of sugar. W. Kelm and E. Beck. *Zeitsch. Zuckerind.*, 1962, **87**, 547–553.—A survey is presented of bulk storage of sugar, the systems used to convey the sugar to and from the silos, types of bulk transport vehicles and the supervision and control of silo charging and sugar distribution. Special mention is made of the humidity and temperature requirements in the silo and of protection against contamination of the sugar by such foreign bodies as rust particles. Three pneumatic conveying systems are described: suction, pressure and pressure-fluidization. Various types of com-

[1] *I.S.J.*, 1962, **64**, 303.

Drying of White Sugar, *continued.*

the principle of rapid circulation of massecuite, and the elimination as far as possible of local spots of high, or under, saturation in a boiling massecuite could conceivably reduce its amount.

We do believe however, that the problem of Inherent Moisture in relation to bulk storage or transport is negligible compared to that of Bound Moisture. In other words, we have no evidence of the release of this moisture in troublesome amounts even over prolonged periods of storage. The only certain way to release it is by grinding or dissolving the crystal.

Acknowledgements

We acknowledge with thanks the permission of the Board of the British Sugar Corporation Ltd. to publish the results of this work. In particular we would thank Mr. J. Campbell Macdonald for his continued interest and encouragement throughout the period, and for providing us with the means of getting the necessary expensive apparatus for our tests. We are grateful to Dr. Jorisch, and to many colleagues for their help and friendly arguments. We thank Donald Hibbert and John Withers for readily supplying information and results, as mentioned in the text. We appreciate the co-operation of Mr. N. Brinton and a large number of Works Chemists, and John Osborne, Assistant Chemist at King's Lynn who was responsible for a great deal of the analytical work.

pressors are described with their advantages and disadvantages listed. Two examples of sugar storage installations are cited showing how the sugar is handled and distributed and the required humidity and temperature conditions maintained. A flow diagram for a 300-ton silo is presented.

* * *

Dissolving of sugar. P. FREUND. *Zeitsch. Zuckerind.*, 1962, **87**, 554–556.—The time necessary to dissolve sugar and the volume of the vessel used are discussed and formulae presented together with a nomogram for determining the dissolving time with batch and continuous mingling in vessels provided with agitators. It is shown that the amount of sugar dissolved per hr per cu.m. of vessel volume is mainly dependent on the state of motion of the sugar and its grain size. Thus, the process should be carried out in a state of suspension when the total sugar surface is made available for mass transfer. The finer the sugar crystals, the greater will be the surface per unit weight and as the surface increases so the time required for dissolving will decrease and the required vessel volume fall.

* * *

Technique of manufacturing standard quality raw sugar under Indian conditions. B. B. GAIROLA. *Indian Sugar*, 1962, **12**, 315–322.—Processes in the manufacture of raw sugar are described from clarification to curing, and recommendations are offered for suitable techniques to be adopted in India. It is pointed out that raw sugar manufacture is somewhat more complicated than the manufacture of direct consumption white sugar as produced in India. The need for high quality raw sugar arises from export requirements.

* * *

An attempt on the problem of low recovery of sugar in the factories of North India. B. L. MITTAL. *Indian Sugar*, 1962, **12**, 323–331.—Causes of low efficiency in sugar factories of North India are investigated by examining the process from cane harvesting to boiling and curing. Possible sources of losses are considered and recommendations are made for avoiding them.

* * *

Modification to heating and evaporating plant. E. J. MOL. *J.A.S.T.J.*, 1961, **23**, 47–52.—Modifications were made to the quadruple-effect evaporator at Jamaica Sugar Estates Ltd. to improve the evaporation rates and reduce steam losses. The effects are of 4500, 4500, 5000 and 2500 sq. ft. h.s., respectively. Vapour is bled to juice heaters from the 1st and 3rd effects; 72 tons of juice are evaporated per hr compared with 61 tons previously, while the evaporator is fed 41,500 lb of steam per hr compared with 49,000 lb/hr. However, while steam consumption has been reduced, the evaporation rate obtained (7·9 lb/sq.ft./hr) is not as high as should be obtained at a temperature head in the evaporator of 102°F, while 1st effect vapour bleeding should give an increase of 0·4 lb/sq.ft./hr. The total deficiency of 0·7 lb/sq.ft./hr is attributed to: absence of calandria baffles, incomplete removal of incondensable gases, air leaks in the 3rd and 4th effects, and to manual control of liquor levels. The last three factors mentioned are to be corrected, although correction of the first, which accounts for most of the deficiency, would be possible only by rebuilding the evaporator. Details are given of the level, Brix and steam flow controls to be installed. In discussion, it is pointed out that an evaporation rate of 7·94 lb/sq.ft./hr represents almost ideal conditions and cannot be improved without using more steam or higher pressure steam. It is also considered that automatic level control should raise the evaporation rate by 10%.

* * *

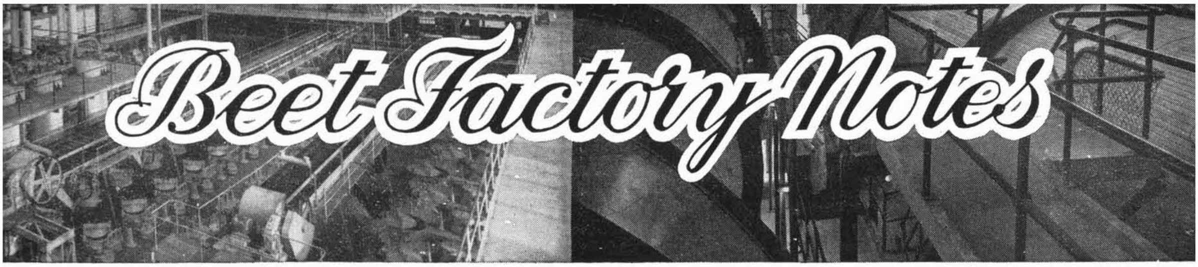
Automation in the sugar industry. J. H. DITMAR JANSSE. *J.A.S.T.J.*, 1961, **23**, 52–57.—Information is given with the aid of a flow diagram on the types of control applicable to each process in the sugar factory and some details are given of equipment available. The advantages and disadvantages of electronic and pneumatic controls are compared; the latter are preferred as they are more robust, simpler and cheaper but will carry out the same tasks as electronic controls. Controller response characteristics are also briefly described. The question of costs is raised in a subsequent discussion.

* * *

Factors influencing factory operations at Barnett Estate. W. A. KENNEDY. *J.A.S.T.J.*, 1961, **23**, 57–60. At this factory, producing about 8000 tons of sugar in a 150-day campaign, the costs of maintenance were reduced from £4·8 to £3·1 per ton of sugar by reorganizing the repair work, raising efficiency and making a close study of annual repair costs per factory unit. The mill capacity was increased from 32 to 40 t.c.h. by using the intermediate carriers as force feeders by giving them a 10° slope to the rollers; by enlarging the exhaust mains of the mill engines to relieve excessive back pressure on the engines; and by replacing the No. 2 mill engine of 200 h.p. with one of 300 h.p. The evaporator capacity was increased from 9·6 to 11·6 lb/sq.ft./hr by converting the six-vessel evaporator (the first three vessels forming the 1st effect of a quadruple-effect) to two triple-effect evaporators. The costs of fuel oil required in addition to bagasse were reduced from £1·23 to £0·28 per ton of sugar by partial electrification, adequate lagging of steam pipes and by installing a closed boiler feed water system, with improved storage capacity for hot condensate used as boiler feed.

* * *

Granular carbons for refined sugar production. D. T. SHVETS. *Sakhar. Prom.*, 1962, (11), 34–36.—Granular activated carbon is compared with bone char and its advantages and disadvantages are considered. Details are given of the system at Odessa refinery with diagrams showing modifications to the filters for granular carbon. Information is also given on a hydraulic conveying system recommended for the granular carbon.



Hot "affination". V. SÁZAVSKY. *Listy Cukr.*, 1962, **78**, 160–162.—This technique, in which hot wash water applied to sugar in the centrifugals is not finely sprayed over a long period but is applied over a very short period of time, is compared with the use of cold water and is found to give higher Brix and lower colour of wash liquor.

* * *

Process for optimum sugar extraction from sugar beet tails. K. HEINRICH. *Zucker*, 1962, **15**, 421–424.—The processing and economics of beet tail diffusion are discussed and details are given of a Buckau Wolf diffusion plant installed at Uelzen sugar factory. From the beet washers the beet tails pass to a conventional beet tail trap which transfers them via a screw conveyor to a cyclone washer, which removes trash and stones. The tails are then pumped to a de-watering trough and then pass to a "preparation" unit where small stones, first liberated from the fibres in the slicers, are finally removed. The plasmolysed tails are them pumped to a tower diffuser which has a capacity of 7·5 cu.m. juice/hr. The extracted tails are pumped to the top of the main tower diffuser and sent with the exhausted cossettes to the pulp presses. Details are given of results obtained over 17 days. Average pol of the fresh tails was 10·89%, and the raw juice was of 8·13% pol and 85·61 purity. Final pol of the pressed pulp from the exhausted tails was 0·55%, corresponding to 0·165% on weight of tails. The average pH in the diffuser was 6, and the average temperature 64°C. Infection did not occur even in the absence of disinfectant. Calculated daily throughput is 136 tons of tails. It is shown that assuming an initial cost of 250,000 DM for the unit, break-even will occur when about 4000 tons of tails have been processed, i.e. about 66 days for a 1500-ton factory.

* * *

An imported (Sangerhausen) programmed centrifugal. G. BAJOR. *Cukoripar*, 1962, **15**, 225–233.—Details and illustrations are presented of flat-bottomed centrifugals manufactured by VEB Sangerhausen of East Germany, and full information is given on the automatic controls[1].

* * *

Return of waste and pulp press water to a Robert diffusion battery. K. HANGYÁL. *Cukoripar*, 1962, **15**, 236–244.—Graphs and flow-sheets accompany a discussion on the advantages and difficulties of waste water return to diffusion batteries. Examples of factory practices are cited. Prerequisite for optimum operation of a return water scheme are: satisfactory pulp removal and disinfection, and precise diffuser operation.

* * *

Practical possibilities of molasses exhaustion. K. WAGNEROWSKI, D. DABROWSKA and C. DABROWSKI. *Gaz. Cukr.*, 1962, **64**, 227–233.—The standard purity of molasses from Polish sugar factories was determined for the 1961 campaign. The results are tabulated, together with the non-sugars contents, ratio of sugar:non-sugars and the sugar losses % on beet. Graphs are also reproduced. It is shown that a further 0·373% sugar (on weight of beet) could be obtained, i.e. an extra 42,000 tons of sugar for the whole of the Polish sugar industry, by effecting complete molasses exhaustion. Suggestions are offered on the processing of after-product massecuites.

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Deliming of sugar factory juices by ion exchangers. P. SMIT. *Sucr. Belge*, 1962, **82**, 6–8.—Reference is made to the article of ZAGRODZKI & ZAORSKA[2] and it is pointed out that other factors besides those discussed have importance in the evaluation of deliming by ion exchange, for instance the savings resulting from lack of scaling in the evaporator. Further, practical experience in Holland and elsewhere reported in the literature has shown greater recoveries of sugar than would be expected from the data obtained by ZAGRODZKI & ZAORSKA.

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Modern practice in beet factory instrumentation. A. LINFORD. *Sugar y Azúcar*, 1962, **57**, (7), 34–38; (8), 24–31; (9), 94–99.—An account is given of the techniques of applying pneumatic and electronic instruments for measurement and control of variables. Diagrams of a beet processing plant are given which show the points of applications of controls—from beet slicers, diffusers, water supply, etc., to the pans—and these are discussed separately in some detail. Finally a survey is made of equipment available for measurement and regulation with illustrations and some evaluation of the various types.

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Technical and economical limits to the insulation of lime shaft kilns. O. ZACHWY. *Zucker*, 1962, **15**, 453–458, 506–508.—Numerous graphs accompany this article on lime kiln operation. It is pointed out that while the trend in recent years has been towards thicker and more efficient insulation, there

[1] *Cf. I.S.J.*, 1962, **64**, 79.
[2] *Sucr. Belge*, 1961, **81**, 137–145; *I.S.J.*, 1962, **64**, 149.

are technical and economical limits to this process. The temperature on the inside wall of the lining will rise with thickness and insulation efficiency and in the burning zone may approach so closely to the maximum gas temperature that the lining may become softened or chemical changes occur that will damage the lining. Consequently, although the heat flow through the kiln wall will fall and a saving in fuel result with increasing lining thickness, the initial and repair costs will be greater. The pattern of these costs for varying lengths of service life is discussed and the optimum economics shown for kilns of various diameters.

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Improving the qualitative properties of production. N. N. TREGUBOVA. *Sakhar. Prom.*, 1962, (9), 23–29. Features of beet sugar manufacture at Borinsk white sugar factory are described. Condenser water used for diffusion at pH 7·4 is continuously acidified with SO_2 to pH 6·2–6·6 in order to combat bacterial infection. The pH is now determined in only four samples instead of throughout the diffuser. This system replaces the use of formalin, which had a detrimental effect on the 2nd carbonatation juice, viz. a slight purity drop and a colour rise due to the reaction between formalin or its polymers and the amino acids and to sucrose inversion caused by formic acid formed by oxidation of the formalin with subsequent hexose destruction. The effect of the pH of the diffusion water on a number of factors is discussed; while alkaline water is not recommended, the pH should not be as low as 5 since this leads to a rise in the invert content of the raw juice and has an adverse effect on filtration. A sulphitation unit is described in which the SO_2 gas is liquefied before adding to fresh water. It was found that the pipeline carrying the treated water to a pressure tank became heavily corroded and glass is recommended. Raw juice tanks are treated with 10–15% (on weight of juice) of unfiltered 1st carbonatation juice. Since this juice is made slightly alkaline, the colloids are taken into solution. The high adsorptive capacity of the $CaCO_3$ particles helps to lower the colour and raise the filtrability of the 2nd carbonatation juice. It is suggested that return of 100% unfiltered juice or 20% juice-clarifier muds suspension (on weight of raw juice) to the raw juice tanks could replace pre-liming and would prevent deposition of albumins on the juice heater tubes. Other advantages are mentioned. With quantities above 100% the effects are reduced. By adding about 10% filter muds suspension (on weight of juice) to returned juice, optimum 1st carbonatation alkalinity was achieved despite too low CO_2 content in the saturation gas caused by kilning inefficiency. Further processing of the juice was good, despite poor quality beet. Details are given of modifications to the vacuum sulphitation tank, with tabulated data before and after the alterations. Some information is given on the boiling practices. Where the alkalinity of thick juice from the evaporators is too low this is raised by adding milk-of-lime.

Investigation of the performance of a twin-scroll sloping type diffuser. I. I. PRILUTSKII. *Sakhar. Prom.*, 1962, (9), 29–33.—Data are given for a twin-scroll DdS-type diffuser installed at Khmelinetsk sugar factory. The daily throughput is 1400 metric tons of beet, at a retention time of 70–80 min depending on scroll speed. Loss figures presented range from 0·18 to 0·57% sugar on weight of beet, but relate to reduced throughput figures, ranging from 257 to 348 tons of beet per 8-hr shift. The sugar content of the cossette samples at various points along the diffuser showed that at a temperature of 75–78°C in the first group of cells, sugar extraction is intensive—at 1700 mm from the diffuser screen the sugar content was 13·9%, and at 6900 mm 8·8%, compared with an initial sugar content of 17·2%. The consenser water used for diffusion is acidified with SO_2 and 10 litres of formalin are added, every 2 hr. Cossette length for fresh beet is 7–9 m/100 g and for frozen beet 6–8 m/100 g. The diffuser is not equipped for automatic control, but is highly recommended for satisfactory sugar extraction, simplicity of construction, ease of maintenance and the small amount of space it occupies. The advantage of plasmolysis and extraction in the same vessel is given special mention.

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The use of hydrocyclones for clarification of flume-wash waters. P. I. SILIN. *Sakhar. Prom.*, 1962, (9), 33–35. The water flows from the washers to a 500-mm dia. hydrocyclone (another, of 350-mm dia., is kept in reserve) via a mixing tank where beet tails and pieces are separated by a screen. Tests show that 33·5–43·5% of the mud is removed. The hydrocyclone unit is to be enlarged.

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The use of mechanical clarifiers at sugar factories. V. R. OSTROMENSKII and R. B. ROVNER. *Sakhar. Prom.*, 1962, (9), 35–36.—Details are given of a horizontal, two-sectioned rotary clarifier with scrapers for the treatment of flume-wash water. The scrapers are raised and lowered from an electrically-propelled trolley which passes backwards and forwards along each section, pushing the muds towards the discharge pipe. The clarifying efficiency is claimed to be higher than with other clarifiers. Milk-of-lime (0·2–0·4% on beet) is added to increase efficiency.

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The temperature conditions in the evaporator station of beet sugar factories. S. I. LIBOV. *Sakhar. Prom.*, 1962, (9), 41–43.—A scheme for quadruple-effect evaporator operation is suggested whereby higher temperatures are maintained in all effects and the 4th effect vapour thus made wholly capable of use for juice heating instead of being only partly used. The amounts of vapour bled from the evaporator are varied while maintaining a given evaporated water balance, e.g. 2nd effect vapour is used for pan boiling instead of 1st and 2nd effect vapours.

LABORATORY METHODS AND CHEMICAL REPORTS

The influence of individual non-sugar fractions on sucrose solubility. F. SCHNEIDER, E. REINEFELD and F. AMDING. *Zucker-Beihefte*, 1962, **4**, 55–71.—Details are given of tests in which the effect on sucrose solubility of non-sugar fractions separated from molasses by ion-exchange was studied. The solutions, containing specified concentrations of non-sugars, were poured into 100-ml flasks and sufficient sugar added that 20% of the weight of syrup was in the form of solid phase. The solubility of sucrose in distilled water was determined as control. The tests were conducted at 20–80°C at varying non-sugar concentrations. The salt fraction was found to increase solubility markedly, while the N fraction had the reverse effect. In the presence of both groups, the effect was additive. Molasses crystallization was carried out using molasses from which the N fraction was removed by ion-exchange and re-added stepwise to the molasses. At a given non-sugar:water ratio, increase in the proportion of the N fraction in the total non-sugars caused a reduction in the sucrose solubility and in the dry solids of the resulting final syrup. The effects of individual non-sugars (betaine, the potassium salt of pyrrolidone carboxylic acid, potassium monoglutamate and potassium chloride) were also studied. In all cases, these substances caused the minimum sucrose solubility to occur at lower concentrations with increasing temperature. The effect was additive when betaine and potassium pyrrolidone carboxylate were present in varying amounts. The tests confirm that each non-sugar fraction not removed from sugar juices is responsible for an additional amount of water in the final syrup in which a certain sucrose portion is dissolved.

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Determination of the density of sucrose solutions at higher temperatures. I. F. SCHNEIDER, D. SCHLIEPHAKE and A. KLIMMEK. *Zucker-Beihefte*, 1962, **4**, 72–76. **II.** D. SCHLIEPHAKE and A. KLIMMEK. *ibid.*, 76–78.

I. A dilatometer was used in determinations of sucrose solution densities (up to 70°Bx) at temperatures up to 90°C. The basis of the method is the weighing of mercury displaced from a filled vessel when the temperature rises as a result of expansion of the test solution. The measurements were possible without evaporation losses. In order to ensure accurate proportioning of the sucrose and water and thus give highly accurate concentration values, the vapour pressure of the water on the surface of or inside the sucrose crystal was measured to within 0·001% accuracy. The sucrose used contained no raffinose and only 0·001% invert sugar and ash. The temperatures were measured and held constant to within ±0·01°C. The density value for 100°C was determined by extrapolation. The results are given in tabular and graph form. The greatest deviation from the mean of parallel measurements was + 0·000025 g/ml (0·002%). The maximum calculated error was ± 0·00006 g/ml (approximately 0·005%).

II. The density of sucrose solutions was determined at 100–145°C. The above-mentioned dilatometer was replaced by a procedure in which the sucrose solution was placed in a calibrated tube which was vacuum sealed before placing in a thermostat where it was brought to the required temperature. Under its own vapour pressure, the sucrose solution assumes a volume corresponding to the temperature. This volume is determined by measuring the height of the meniscus in the tube; the expansion of pure water was also determined and thus the ratio of solution density:water density. The true densities were then obtained by multiplying by known water densities. The maximum deviation from the mean was $\pm$ 1·0 $\times$ 10^{-4} g/ml (0·10%). Values for 5–30 weight % sucrose at 100°C agree very closely with the extrapolated values given in I above.

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Dampening of refined sugar. I. J. BUREŠ and M. FRIML. *Listy Cukr.*, 1962, **78**, 169–175.—Laboratory tests were conducted on refined sugar samples of different types and ash content in which atmospheres of constant R.H. were created by means of various saturated salt solutions, and the sugar samples placed in them after first drying for 90 min at 105°C. It was found that at constant temperatures the equilibrium humidity of refined sugar is unattainable at high relative humidities but that the dampness of the sugar is proportional to the time of contact with the atmosphere. At low R.H. values, equilibrium humidity is soon achieved. The higher the ash content, the higher will be the equilibrium humidity; a higher ash content also causes a displacement of the region in which the sugar humidity tends to fall with decreasing atmospheric R.H. The non-sugars have a greater effect on the equilibrium humidity of the sugar at higher temperatures. The equilibrium humidity of sugar is dependent on temperature, unlike the vapour tension which is therefore a better indicator of the equilibrium between the surface syrup and the atmosphere than the equilibrium R.H.

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Study on the conductimetric measurement of ash in Taiwan sugar and molasses. IV. Investigation for determining the conductivity ash in final molasses. Y. C. CHENG. *Rpt. Taiwan Sugar Expt. Sta.*, 1962, (28), 187–192.—Since the ash content of Taiwan final molasses and specific conductance of their solutions are related approximately linearly, accuracy of conductivity measurements of ash is influenced only slightly by the effects of anionic constituents, and the correlation coefficient is 0·94. Since the ash content varies from 8 to 20%, this is high enough to reduce the relative error in conductimetric ash measurement. Thus, ash may be estimated either by simple C-ratio or a regression method provided a concentration of 2 g/100 ml is used and the samples thoroughly mixed. Although the C-ratios of molasses from 29 Taiwan sources vary within the range 4110–4910, they can be sub-divided into 5 ranges: 4110–4251 (3 mills), 4315–4389 (7 mills), 4468–4596 (9 mills), 4693–4700 (8 mills) and 4823–4910 (2 mills). Examination of statistical errors by using the C-ratio and regression method for treatment of the conductivity and chemical ash shows that use of the simpler former method is justified. Average relative error in conductivity ash is 3%, although it was higher—up to 11%—in 4% of the samples examined.

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The filtration coefficient F_k. J. DOBRZYCKI. *Gaz. Cukr.*, 1962, **64**, 267–269.—See *I.S.J.*, 1963, **65**, 28.

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Statistical study on trash and recovery in sugar mills. Y. K. YUEN and H. M. LIAW. *Taiwan Sugar*, 1961, **8**, (12), 16–20.—Examination of manufacturing reports disclosed a relationship between cane trash (x) and sucrose recovery (y); as the former increased the latter fell in accordance with an equation $y = 93 - 3{\cdot}48x$, the correlation coefficient for which is 0·99. For a minimum recovery of 86% the trash content must be below 2%. With trash less than 1·4% the effect on total recovery becomes less significant than the other factors influencing recovery.

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Enthalpy diagram for sugar-water solutions. T. BALOH. *Zucker*, 1962, **15**, 444–451, 500–505.—Details are given of the procedure used in the plotting of an enthalpy diagram for aqueous sugar solutions (in this case, of 94·3 purity). The diagram is based on known calorific values for sugar, water and solutions of these. The actual components are: enthalpy (kcal/kg), solution concentration and temperature (0–140°C). The diagram's application is demonstrated by a number of examples: for calculating the resultant temperature in mixing of juices, dilution and melting of crystal sugar, heating and cooling of juices and massecuites and after-crystallization with boiling of syrup to massecuite. A special Mollier entropy-enthalpy diagram for vapours from aqueous sugar solutions with curves of concentration for the original solution is also presented. This may be used for calculations in the evaporation process.

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Rate of sucrose crystallization from a mixture of beet syrup and a cane raw sugar solution. I. F. ZELIKMAN and N. L. TROYANOVA. *Sakhar. Prom.*, 1962, (9), 21–23.—The effect of adding cane raw sugar to beet syrup on the crystallization rate was studied. The saturation coefficient of the initial products and of the mixtures were determined and sufficient pure sucrose added to give a required unspecified supersaturation. The crystallization rates were then determined at 40°C by KUKHARENKO*'s method[1], adding 2–3 sugar crystals each weighing 0·5–1·2 g to 50 g of the product in a sealed glass cylinder in a laboratory thermostat. The rates are tabulated and illustrated in graph form.

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New tables of sucrose solubility in water. G. VAVRINECZ. *Zeitsch. Zuckerind.*, 1962, **87**, 481–487.—Published data on sucrose solubility in pure water show marked differences. Tabulated values are given for a number of authors showing the temperature range examined, the number of values determined, the degree of scatter, and the mean deviation in each series. A statistical method was used to give mean values from the published data and these were used as a basis for an empirical formula calculated by the method of least squares: $p = 64{\cdot}447 + 0{\cdot}08222\ t + 0{\cdot}0016169\ t^2 - 0{\cdot}000001558\ t^3 - 0{\cdot}0000000463\ t^4$, where p is the weight % and t is the temperature in °C. The equation is suitable for values between —13°C and +100°C but not for extrapolation outside these limits. The calculated values (as % solubility and molar fractions) are tabulated. Scattering was found to be ± 0·208% and the mean probable error + 0·05%. Despite the small error, the considerable degree of scatter makes it impossible to assume any absolute value and further experiments would be necessary for more accurate values. Graphs are presented showing the degree of scatter of solubility values of the various authors cited, and 39 references are given to the literature.

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Determination of the degree of sugar extraction from factory molasses. E. GRUT. *Zeitsch. Zuckerind.*, 1962, **87**, 492–494.—The standard method used in Danish sugar factories for determination of molasses exhaustion is described. The molasses sample is concentrated to a non-sugar:water ratio of 2·90, sugar crystals of 0·46–0·63 mm sieve being added. Crystallization is then carried out at 40°C in a thermostat and the change in purity after 48 hr determined from the refractometric Brix measurement. The degree of sugar extraction is expressed by a so-called "crystallization value" which indicates the percentage of sugar crystallized out of the molasses. The accuracy of the test method is about ± 11% on the calculated crystallization value.

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Sugar cane yield calculation. J. P. ARGENZIO. *Quím. Indust.*, 1961, **7**, (1), 12–21.—A rather complicated formula is developed for yield of recoverable sugar based on cane and crusher juice analysis, and including a number of assumptions, empirical factors, etc. Values are tabulated for a range of 77·0 to 88·4 purity and 11·0–17·0% fibre with intervals of 0·2 purity and 0·5 fibre. The effect of various factors on the formula is discussed.

* I. A. KUKHARENKO, earlier referred to as J. A. KUCHARENKO.
[1] *Vestnik Sakhar. Prom.*, 1922, (3–4).

BY-PRODUCTS

Surfactants based on sugar. G. R. AMES. *Tropical Sci.*, 1962, **4**, 64–73.—A survey, with 74 references to the literature, is made of the prospects for use of sucrose ester detergents, emulsifiers, etc., as well as of their preparation.

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Furfural from sugar cane bagasse. J. N. GOEL. *Indian Sugar*, 1962, **12**, 129.—A brief note is given on the uses of furfural and its production at Central Romana[1].

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Yield increase in the production of fodder yeast. II. Semi-continuous cultivation of a new species and utilization tests of inferior raw materials. V. GRÉGR. *Sborn. Praz. Vys. Skol. chem.-Technol.. Potravin. Technol.*, 1960 (1962), 101–136; through *J. Sci. Food Agric. Abs.*, 1962, **13**, ii–58.—It has been shown previously on a laboratory scale that *Saccharomyces cerevisiae* Hansen var. *tropicus* gave the same yield of fodder yeast as the more commonly used *Torulopsis* or *Candida*; the method of fermentation was considerably simplified. In the present investigation, production trials are described; a comparatively high yield of 46·1 to 57·1% of fodder yeast (calculated from the total sugar) was obtained in spite of the utilization of inferior substrates such as used molasses worts and yeast effluents.

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Statistics in a research problem. O. KONONENKO. *Sugar Molecule*, 1961–62, **11**, (3), 17–25.—By applying the statistical method of "steepest ascent" to a determination of the conditions giving a maximum yield of piperazines produced by reductive aminolysis of sucrose, it was possible to increase the yield to 29·2% on the weight of sugar, i.e. one mole of piperazine per mole of sucrose. Since the piperazines obtained were mainly in the form of 2-methyl-piperazine, it is concluded that the initial step in the reaction is condensation of fructose and glucose with two moles of ammonia.

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Weighing of molasses in distilleries. E. R. DE OLIVEIRA. *Brasil Açuc.*, 1962, **59**, 113–122.—Factors affecting the weighing of molasses are briefly discussed, including viscosity, occluded air and gases, air introduced during centrifugalling, presence of insolubles, and the presence of CO_2 resulting from decomposition during storage. Systems of weighing are reviewed; these include estimation from the tank volume and density (which involves an error of the order of 4½%), from the tank area of cross section and pressure exerted at the bottom of the tank, measured with a mercury manometer by the methods of Mezzaconi or Eisner, or with a pneumercator gauge (error 0·6%), and by direct weighing in automatic scales (error 0·1–0·3%).

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Notes on a variant of the Melle-Boinot process. W. DREWS. *Brasil Açuc.*, 1962, **59**, 123–124.—A 1:1 suspension of yeast in water is maintained at pH 3·6–3·8 for 2 hr with constant agitation and is then passed to a tank and mixed with an equal volume of an 18°Bx must, 0·02–0·03 g "Emulsan AL" also being added per litre (on final volume). The Brix falls to 5–6° within an hour, when 18–22°Bx must is added continuously at a rate such that the Brix is maintained at 9–11°. In this way, the fermentation is surprisingly short (5–7 hr) and alcohol yield is optimum, thus increasing the capacity of the fermentation plant.

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Recovery of betaine using ion exchange resins. G. B. AIMUKHAMEDOVA, M. I. DAISHEV and K. P. ZAKHAROV. *Izv. Akad. Nauk Kirgiz. SSR, Ser. Estest. i Tekhnich. Nauk*, 1961, **3**, (2), 139–141.—Betaine may be recovered by treatment of molasses solution or vinasse with a strongly acid cation exchanger in H form and eluting with ammonia solution. The betaine is recovered from the eluate by evaporating to 60–65% dry solids and treating with active carbon after adjusting to pH 2·5–3·0 (for removal of humins and colour substances). HCl is then added to convert the betaine to its hydrochloride form at pH 0·8-1·0 and the solution is then re-evaporated. After crystallization and centrifuging, the crystals are washed with water and dried. Although the betaine hydrochloride is somewhat coloured, no ash or ammonia has been detected. Re-crystallization and active carbon treatment with additional washing with alcohol is sufficient to give a high purity product suitable for medicinal purposes. The applications of betaine are listed.

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Feeding beet pulp and beet molasses to livestock. R. R. LACY. *Sugar J.* (La.), 1962, **25**, (4), 10–14.—The use of dried beet pulp and pulp pellets as animal fodder is discussed as well as beet molasses fodder, which is compared with cane molasses.

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Add bagasse to sow ration for weight control. D. M. THRASHER. *Sugar J.* (La.), 1962, **25**, (4), 16–18.—Tests were carried out in which sows were hand-fed with standard rations and were self-fed with rations containing 30% and 40% bagasse "fines" (as roughage), plus 30% molasses. The best weight gains (*not* the maximum) were obtained with the ration containing 40% bagasse. The sizes of the litters produced by the sows favoured self-feeding. Possible alternatives to the bagasse are suggested.

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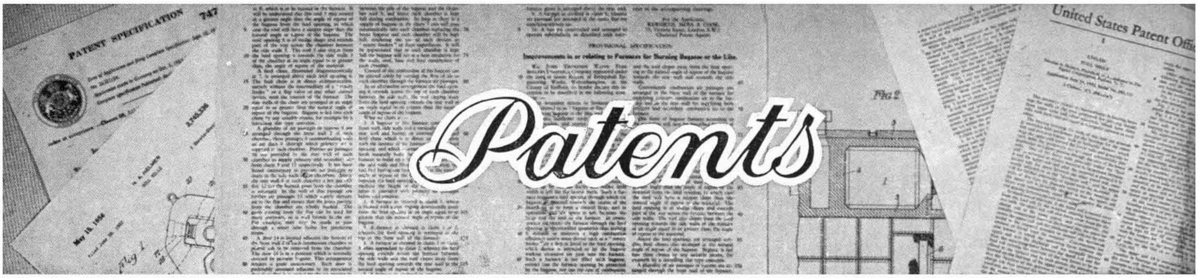
Molasses as a feed ingredient. J. R. LEPINE. *Sugar J.* (La.), 1962, **25**, (4), 26–30.—The advantages of molasses as animal fodder are enumerated and recommendations are offered on feeding levels. The various problems associated with molasses fodder are discussed, including estimation of the feeding value, storage and handling.

[1] *I.S.J.*, 1954, **56**, 224–225; 1955, **57**, 103.



UNITED KINGDOM

Dextran and its production. COMMONWEALTH ENGINEERING CO. OF OHIO, of Dayton, Ohio, U.S.A. **910,736.** 24th October 1960; 21st November 1962.—Clinical dextran of mol.wt. 50,000–100,000 (75,000 average) is produced by inoculating a sucrose-bearing nutrient medium with a dextran synthesizing bacterium, e.g. *Leuconostoc dextranicum* or *L. mesenteroides*, concurrently with a hydrolytic degrading organism, e.g. *Aspergillus Wentii.* The degraded crude dextran is precipitated by addition of methanol.

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Purification of sugar esters. DR. SPIESS G.M.B.H., of Kleinkarlbach-über-Grünstadt, Germany. **911,063.** 23rd February 1961; 21st December 1962.—Sugar esters of acids with 6–30 C atoms, e.g. sucrose mono- or di-stearate, are dissolved, suspended or emulsified in water, acid added to bring it to N/1000–N/100, and the product subjected to continuous counter-current dialysis with water or with weakly acid aqueous solution followed by water. The ester may be pre-purified by precipitation with an electrolyte from aqueous solution, suspension or emulsion and subsequent separation.

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Beet harvester. T. J. JONES and E. B. BRAND. **911,478.** 25th May 1961; 28th November 1962.

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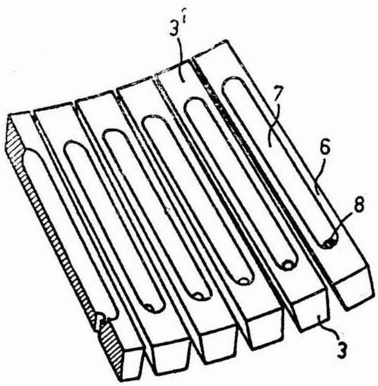
Preparation of sucrose esters. LEDOGA S.P.A., of Milan, Italy. **912,595.** 20th March 1959; 12th December 1962.—Sucrose and an alkyl (1–3 C atoms) ester or glyceride of a long chain fatty acid (6–30 C atoms) are inter-esterified in the presence of dimethylformamide as solvent and a basic catalyst, followed by (filtration and) addition of a lower aliphatic carboxylic acid (2–4 C atoms) to the reaction mixture to adjust the pH to 5–7. The unreacted fatty acid ester and free fatty acid are extracted with a solvent (petroleum ether) immiscible with dimethylformamide, capable of dissolving the ester and acid but in which the sucrose ester is insoluble. After evaporation to dryness *in vacuo* of the bulk of the solvent, the residue is dissolved in a mixture of two solvents, one being an aliphatic alcohol partially soluble in water and capable of dissolving the sucrose ester (*n*-butanol) and the other a solvent totally insoluble in water and not capable of dissolving dimethylformamide (cyclohexane). Unreacted sucrose is extracted from the solvent mixture by washing with water and aqueous brine and the purified ester recovered by evaporation of the solvents.

Screen linings for push-type centrifugal machines. ESCHER WYSS A.G., of Zurich, Switzerland. **913,892.** 1st September 1959; 28th December 1962.—To prevent abrasion of sugar crystals passing through the machine, the linings are in the form of bars 3 in the direction of the drum axis, the glide surfaces 6 having trough-like depressions 7 in them. These retain a certain amount of mother liquor which acts as a lubricant, reducing crystal wear. The troughs start beyond the region over which passes the pusher plant, and are also provided with outlets 8 to prevent the retained mother liquor from being discharged with the sugar. The bars may be connected together, or may be in the form of plate strips having portions curved in a trough-like manner.



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Esters of sugars, hexitols and anhydrosugars. HOWARDS OF ILFORD LTD., of Ilford, Essex. **915,578.** 25th May 1959; 16th January 1963.—A C_{12}–C_{30} (C_{16}–C_{20}) ester or mixed esters of C_1–C_3 alcohols is subjected to alcoholysis with the sugar (sucrose), hexitol (sorbitol, mannitol or dulcitol), or anhydrosugar (sorbitan) in the presence of an alcoholysis catalyst in a liquid reaction medium (dimethylsulphoxide) inert under the reaction conditions and in which the catalyst, sugar, hexitol, or anhydrosugar (and ester product of the alcoholysis) are soluble but the fatty acid ester or ester mixture is substantially insoluble. The phases of the reaction mixture are contacted in a thin film under conditions whereby there is rapid exaporation of the alcohol liberated in the reaction (in a cyclone evaporator).

Copies of Specifications of United Kingdom Patents can be obtained on application to H.M. Patent Office, 25 Southampton Buildings, London, W.C.2. (price 4s. 6d. each). United States patent specifications are obtainable from: The Commissioner of Patents, Washington, D.C. (price 25 cents each).

UNITED STATES

Load indicator for centrifugal separator. W. C. SMITH and C. K. HENNINGER, *assrs*. AMETEK INC. **3,044,625.** 4th November 1957; 17th July 1962.—The load indicator comprises a series of removable thin detector blades mounted on a vertical shaft which is partly held in a sleeve inside the centrifugal basket. The blades detect the annular layer of material inside the basket and can turn the shaft with respect to the fixed sleeve. An arm at the other end of the shaft can operate a switch governing the feed to the centrifugal, and the sensitivity of the detector may be varied by altering the number of blades employed.

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Separation of dextrose and levulose. (A) G. R. SERBIA, of Aguirre, Puerto Rico, *assr*. CENTRAL AGUIRRE SUGAR CO. **3,044,904.** 15th February 1960; 17th July 1962. (B) and (C) L. J. LEFEVRE, of Midland, Mich., U.S.A., *assr*. DOW CHEMICAL CO. **3,044,905**; **3,044,906**; 15th February 1960; 17th July 1962.

(A) An aqueous (10–60%) solution of dextrose and levulose is fed (at 20–80°C and at 0·1–0·5 gal/min/sq.ft.) to a water-immersed bed of the calcium salt of a nuclear sulphonated styrene cation exchange resin (polymerized from mixtures containing 1–12% of divinylbenzene as a cross-linking agent). This displaces the water from the resin. Thereafter water is fed to the bed to displace further liquid which is collected in successive fractions, including a fraction which contains principally dextrose and another principally levulose. The same sequence can then be repeated using the same bed for a further amount of the solution of the mixed sugars.

(B) A similar technique is used whereby a 10–40% solution of dextrose and levulose (and sucrose) is fed to a water-immersed column of either the Ba or Sr salt of a nuclearly sulphonated styrene cation exchange resin sufficiently cross-linked (with 0·5–15% by weight of divinylbenzene) to render it insoluble in acids, bases and salts. The sugars are absorbed by the resin salt and are then eluted to give a fraction containing the levulose and another the dextrose (and sucrose).

(C) In this case the resin is in the form of a silver salt and may contain 0·5–8% by weight of divinylbenzene for cross-linking.

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Enzymatic synthesis of dextran. U. BEHRENS and M. RINGPFEIL, of Leipzig, Germany, *assrs*. VEB SERUM-WERK BERNBURG. **3,044,940.** 5th May 1961; 17th July 1962.—An inoculum of a culture of *Leuconostoc mesenteroides* (or *L. dextranicum*) is transferred to a nutrient propagating solution including as a source of carbon lower molecular aliphatic acids and alcohols but containing no primers or primer generating substances such as glucose polymers, *iso*-maltose, panose, sucrose, etc. An inoculum from the propagating solution is transferred to an aqueous sucrose solution for further fermentation and dextran recovered by fractional precipitation with a lower aliphatic alcohol.

Producing itaconic acid. R. C. NUBEL and E. J. RATAJAK, *assrs*. CHAS. PFIZER & CO. INC., of New York, N.Y., U.S.A. **3,044,941.** 26th April 1960; 17th July 1962.—Itaconic acid and its salts are produced by submerged aerobic fermentation (at 35–42°C) of an itaconic acid-producing *Aspergillus* (*A. terreus* or *A. itaconicus*) in the presence of beet molasses as the source of 10–30% of the carbohydrate present. When the itaconic acid content reaches 2–5 g/100 ml, 20–50% of it is neutralized and the fermentation allowed to proceed until acid production is negligible. Beet molasses may be used thus in growing an inoculum and the latter transferred to a cane molasses medium for production fermentation. In both cases the molasses contains 10–18% total sugar w/v.

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Countercurrent extraction. (Beet diffusion.) A. E. GOODBAN and J. B. STARK, *assrs*. U.S. SECRETARY OF AGRICULTURE. **3,047,430.** 26th May 1961; 31st July 1962.—Water is fed to a counter-current beet diffusion apparatus in two streams, the first—an impure supply water, e.g. river or well water, containing a relatively high mineral content—being added at the tail, while the second—low-mineral water such as condensate—is added at a distance along the diffuser from the tail. The exhausted cossettes are thus placed in a high mineral zone and take out a part of the dissolved minerals which are absorbed by the beet tissue. The mineral-containing water is thus purer when it mixes with the condensate and the resultant juice contains less minerals than if the two water supplies are mixed and added together at the tail end of the diffuser.

* * *

Sugar ethers. V. R. GAERTNER, of Dayton, Ohio, U.S.A., *assr*. MONSANTO CHEMICAL CO. **3,048,577.** 5th December 1958; 7th August 1962.—The ethers are of the formula $R-Y-\underset{\displaystyle |\atop \displaystyle OH}{X}-OZ$, in which R is a hydrocarbyl radical of 7–24 C atoms (alkyl or alkylaryl), Y is either sulphur or oxygen, X is a trivalent paraffinic hydrocarbon radical of 3–5 (3) C atoms carrying the OH group at the 2-position with respect to the OZ group where Z is a non-reducing sugar (sucrose) or sugar alcohol (sorbitol). R may be a tridecyl, *n*-dodecyl, dodecylphenyl, *iso*-decyl, or abietyl group, and the ether may be prepared by reacting, in an inert solvert (dimethylsulphoxide) and in the presence of an alkali metal hydroxide as catalyst, the sugar or sugar alcohol with a substantially equimolar quantity of a compound $R-Y-\underset{\displaystyle |\atop \displaystyle T}{X}-OH$ where T is a halogen and where T and OH are joined to adjacent C atoms in the radical X neither being the C atom to which Y is attached [a 3-alkoxy-1,2-chloropropanol (chlorotridecyloxypropanol obtained by reaction of epichlorohydrin with "Oxo"-process, branched chain tridecanol)].

Screen lining for a push-type centrifugal. E. RUEGG, of Kusnacht, Switzerland, *assr.* ESCHER WYSS A.G. **3,049,241.** 13th August 1959; 14th August 1962.—See U.K.P. 913,892[1].

* * *

(Continuous) Centrifuges. W. SIEPE, of Düsseldorf, Germany, *assr.* HEIN, LEHMANN & Co. A.G. **3,050,190.** 27th January 1960; 21st August 1962.—See U.K.P. 872,969[2].

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Production of levulose. A. G. HOLSTEIN and G. C. HOLSING, *assrs.* DAWES LABORATORIES INC. **3,050,444.** 3rd April 1959; 21st August 1962.—A sucrose solution is inverted, a nutrient salt mixture and corn steep liquor added and the resulting broth fermented in the presence of glucose oxidase [inoculated with a glucose oxidase-producing mould (*Aspergillus niger* NRL-3)] at 28–38°C, maintaining at pH 4·5–6·5 by addition of an alkalizing agent (NaOH, $CaCO_3$) and introducing air at 28–32 p.s.i. and at 4·5–5·5 c.f.m., increasing to 12–14 c.f.m. after 2–3 hr, and continuing until the optical rotation is 2·3 times its initial value. The fermentation product is filtered through active carbon and filter aid, concentrated under vacuum to 1·45–1·50 s.g. and treated with 50% by volume of methanol. The product is allowed to stand until precipitation of gluconate salts is complete, when these are removed and the methanol distilled off. After adding an equal volume of water, the levulose solution is filtered through active carbon and filter aid and passed through a (strongly acidic polystyrene nuclear sulphonic acid) cation exchange resin and a (weakly basic phenol formaldehyde polyamine) anion exchange resin whereby the ionic content is reduced to 0·7–15 grains per gallon. The effluent is concentrated under at least 26 in vacuum to 1·45 s.g., heated with 50% by volume of methanol and cooled, when levulose crystallizes. The crystals are separated, washed with methanol and dried under vacuum.

* * *

Hydrolysis of bagasse. J. R. DE LA VEGA F. and E. RAMOS R., of Vedado, Havana, Cuba, *assrs.* INSTITUTO CUBANO DE INVESTIGACIONES TECNOLÓGICAS and UNIVERSIDAD DE VILLANUEVA. **3,051,611.** 16th November 1959; 28th August 1962.—Water is treated to remove its O_2 and CO_2 content by boiling and adding 1–10 p.p.m. of sodium sulphoxylate. It is mixed with bagasse in a digester and the latter flushed with nitrogen or with water vapour produced by boiling the water. The digester thus has an inert atmosphere and the bagasse is hydrolysed by heating under pressure at 250–400°F (300–380°F, 320–360°F) for 1–5 hr (1–4 hr, 2–3 hr) until the pentosan content does not exceed 20% (15%). In this way, the pentosan content is reduced while minimizing the polymerization of the holocellulose content. The water used may be the liquid obtained from a previous hydrolysis, neutralized with alkali.

Preparation of carbohydrate monoesters. V. R. GAERTNER, of Dayton, Ohio, U.S.A., *assr.* MONSANTO CHEMICAL CO. **3,053,830.** 2nd November 1959; 11th September 1962.—Water-soluble monocarbohydrate carboxycarboxylic acid ester surface active agents are prepared by mixing and reacting a carbohydrate having no more than two saccharide units (sucrose) with 0·25–1 mole of a cyclic acid anhydride containing 10–25 C atoms and having 6–20 C atoms in the side chain and 4–6 C atoms in the ring (tri-*iso*butenyl succinic anhydride, tetrapropenyl succinic anhydride) per mole of carbohydrate in the presence of a C_1–C_6 dialkylacylamide or dialkylsulphoxide as solvent (dimethylformamide, dimethylsulphoxide) and a basic tertiary amine catalyst (pyridine) at 50–120°C for ¼–18 hr. The ester product is separated from the solvent and catalyst mixture and neutralized with an aqueous alkali.

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Beet harvester. C. J. STEKETEE, of Zevenbergen, Netherlands. **3,054,460.** 27th September 1960; 18th September 1962.

* * *

Preparation of pure sucrose esters. V. D'AMATO, of Milan, Italy, *assr.* LEDOGA S.P.A. **3,054,789.** 13th March 1959; 18th September 1962.—Sucrose is interesterified with a glyceride or lower alkyl ester of a monocarboxylic fatty acid, e.g. methyl palmitate or stearate, in a solvent, e.g. dimethylformamide, in the presence of a basic catalyst, e.g. anhydrous K_2CO_3, followed by addition of a lower aliphatic acid, e.g. acetic or propionic acid, to the reaction mixture at the end of interesterification to neutralize it. The unreacted fatty acid ester and free fatty acid are extracted with petroleum ether, and the residue evaporated (under vacuum) to dryness and dissolved in an approximately 1:1 mixture of cyclohexane and *n*-butanol (at 45–50°C), washed with water, the water extract separated and the cyclohexane/*n*-butanol solution evaporated (under vacuum) to dryness to give the sucrose ester.

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Centrifuges. N. V. ANDERSSON, of Landskrona, Sweden, *assr.* A. B. LANDSVERK. **3,056,505.** 20th October 1959; 2nd October 1962.—See U.K.P. 864,596[3].

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Non-crystallizing sucrose lower fatty esters and compositions thereof. G. P. TOUEY and H. E. DAVIS, of Kingsport, Tenn., U.S.A., *assrs.* EASTMAN KODAK CO. **3,057,743.** 2nd April 1959; 9th October 1962.—The combinations are of 30–95% of a lower fatty acid ester of cellulose with 5–70% of sucrose propionates or *iso*butyrates having 0·25–1·50 (0·4) (0·8) unesterified hydroxyl groups per mole of sucrose. The latter esters serve as plasticizers for the cellulose ester film.

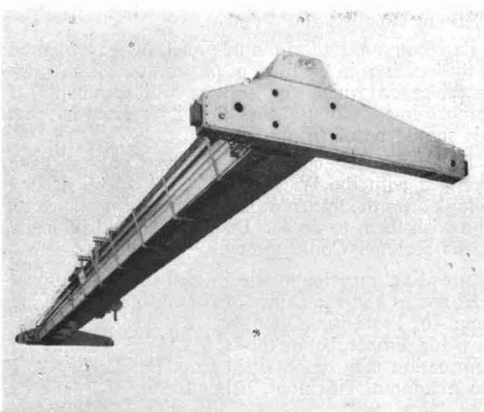
[1] *I.S.J.* 1963, **65**, 90.
[2] *I.S.J.*, 1961, **63**, 322.
[3] *I.S.J.*, 1961, **63**, 287.

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.

"Monobox" overhead travelling crane. J. H. Carruthers & Co. Ltd., College Milton, East Kilbride, Glasgow, Scotland.

The "Monobox" travelling crane is a new departure in this field in that it uses one single welded box girder, which has the important effect of great reduction in the supporting gantry stanchions, etc., with consequent savings, and also a reduction in the height of the building to incorporate the cranes. Further advantages include the almost total elimination of all maintenance and low initial cost. Stress analysis of all components have ensured ample strength with minimum dead weight so that the dead to live load ratio is superior to more conventional cranes.



Standard cranes are available for 1-ton to 25-ton capacities and spans of 20 to 130 ft. Quotations for cranes outside this standard range will be supplied on request. Lubrication is reduced to intervals of 1000 hours of running life, while the flangeless trolley wheels are fitted with "Duthane" tyres to eliminate noise and impact. All cranes carry a 2-year guarantee.

* * *

PUBLICATIONS RECEIVED

VALVE LININGS. Saunders Valve Co. Ltd., Cwmbran, Monmouthshire.

The Saunders diaphragm valve body, with its streamline, pocketless passage, lends itself so readily to lining that it is possible to offer various specifications as standard alternatives for handling many of the difficult and delicate fluids used in modern industrial processing. Saunders valve linings brochure SD/VL/1162 gives full detail of the materials most commonly employed for this protective purpose; these include several grades of rubber, both hard and soft, the latter mainly used where abrasives and slurries are being handled, glass—popular for its cleanliness and absence of anything to cause contamination of foodstuffs, beverages, pharmaceuticals, etc.—metals such as lead and titanium, plastics such as "Penton", PVC, polyethylene and other proprietary linings. Individual body castings chiefly of Meehanite cast iron are specially profiled and pretreated to accept specific linings.

PYE INGOLD pH ELECTRODES AND ACCESSORIES. W. G. Pye & Co. Ltd., Granta Works, York St., Cambridge.

A new short-form catalogue, No. 130-963, describes the new range of electrodes and accessories, manufactured to the specifications of Dr. Werner Ingold of Zürich, Switzerland. Most of the Pye Ingold Electrodes are manufactured from a universal glass which is extremely tough with resultant comparative freedom from breakages. Included are combined electrodes in which the functions of the glass electrode and the reference electrode are combined into a single robust measuring unit, high temperature electrodes which are suitable for accurate and continuous pH measurements in boiling aqueous solutions and can be taken as high as 130°C without any fear of damage, low temperature electrodes made from a special low resistance glass which enables accurate measurements to be made at temperatures as low as —10°C, and industrial pH electrode housings which are available in several forms and are manufactured from a variety of corrosion-proof materials to satisfy the most stringent requirements.

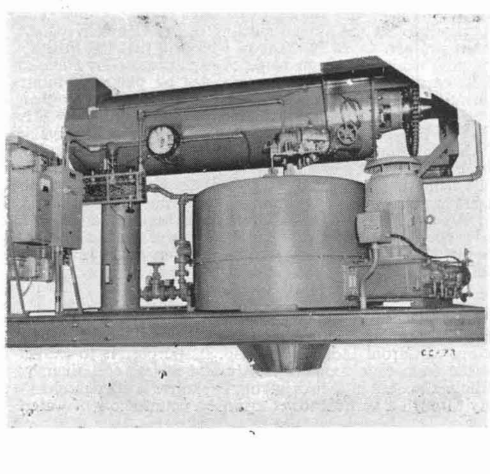
* * *

"SERIES 300" ELECTRONIC TRANSMISSION SYSTEM. Evershed & Vignoles Ltd., Acton Lane, London W.4.

A new series of measurement transmitters, designated Series 300, together with a new transistorized Power Unit for use with any of the transmitters, is described in a new leaflet SS.37. The sensing system of the Series 300 transmitters retains the principle of force balance used in the Evershed electronic repeater system, but makes use of a capacity sensing device giving improved accuracy and sensitivity. The moving vane of the capacitor is connected to a transistor oscillator, the fixed vanes being connected to a differential rectifier and transister amplifier. The oscillator/amplifier circuits are encapsulated in a block of epoxy resin mounted within the transmitter.

* * *

New Western States continuous centrifugal.—The first Western States continuous-type centrifugal is now in operation at the Georgia Refinery Division of the South Coast Corporation, Mathews, Louisiana. It is a 34 in × 34 in type CC conical basket continuous centrifugal. According to a company spokesman the centrifugal was installed in May, 1962. It has been in regular production since then on final crystallizer massecuite. The new Western States unit is driven by a 40 h.p. motor and operates at 2200 r.p.m. It is equipped with a specially designed Stevens coil to supply the feed massecuite at a constant temperature.



COMMISSION INTERNATIONAL TECHNIQUE DE SUCRERIE (C.I.T.S.)

Paris Congress: June 1963

By invitation of the Syndicat National des Fabricants de Sucre de France, the 12th General Assembly of the C.I.T.S. will take place in Paris on the 17th–20th June 1963. The meetings will be held at the Majestic in the Avenue Kleber.

Two subjects will have priority:

(i) Colour formation and its consequences in the sugar factory, and

(ii) Molasses formation.

Other topics which may be the subject of communications are:

(i) Beet storage—estimation of losses.

(ii) Study of natural alkalinity and lime salts.

(iii) Problems concerning steam economy.

(iv) Ion exchangers and the problems with waste waters resulting from their regeneration.

(v) Comparative study of continuous and automatic cycle centrifugals.

(vi) Treatment of sugar with a view to its storage—sugar dust explosions.

(vii) Sucrochemistry—Outlets for sugar and molasses.

(viii) Corrosion—Use of special materials.

Authors intending to present communications are asked to conform to the following conditions:

(a) To be accepted, the communications must have a character exclusively scientific or purely technical, without any commercial allusion or publicity, direct or indirect.

(b) Five copies of the complete text, including diagrams and tables, must be sent to the General Secretary, 1 rue Aendoren, Tirlemont, Belgium, before the 15th March, 1963. After this latest date communications cannot be included in the programme of the Congress.

The texts will be scrutinized by the examining committee who will make known to the interested parties, before the 1st April, the decision taken concerning the admission of their work.

150 copies of the texts of the papers which have been accepted must be sent to the General Secretary before the 1st May next so that they may be distributed in good time to participants. Each communication should have a detailed summary in 3 languages (German, English and French).

Each communication should preferably be presented at the meetings in the form of projections of drawings or tables on which the authors will comment. If authors intend to use ciné-film, it is essential that this should be of 16 mm size.

The organizing committee of the Congress have arranged with the Wagons-Lits Cook travel agency to look after the transport and lodging of participants who wish them to do so. Enquiries should be made at the regional Cook agency.

Intending participants are invited to make known their names and the names of persons accompanying them to Professor Dubourg, 23 Avenue d'Iena, Paris 16e, France, before the 1st May 1963. Additional information may be obtained from Dr. J. Henry, 1 rue Aendoren, Tirlemont, Belgium.

Sugar Research Ltd. programme[1].—Sugar Research Ltd. plans to step up and expand its activities by securing further experienced staff and adding to its research equipment. This was disclosed at the annual meeting of the Company by the Chairman, Mr. C. A. N. Young, who said that the Institute was now ready for a new stage of expansion. The Director of Research, Dr. J. R. Allen, reported on plans for future research activities and paid tribute to member mills for their foresight in establishing their own research institute. He said this had been in some considerable measure responsible for the high standard of efficiency existing in Queensland mills. The previous year's chemical research had resulted in some mills achieving appreciable increases in filtrability of their sugars which was so important in capturing world markets. Dr. Allen said that, in addition, sugar boiling had been a major subject for investigation and courses of instruction were conducted in the Bundaberg area by members of the Institute's staff.

* * *

Cane diffusion in Trinidad[2].—An experimental continuous diffusion unit has recently been installed at Brechin Castle factory of Caroni Ltd., in Trinidad. Its purpose is to extract sucrose from cane more efficiently and at less cost than by milling. Cane cut into discs by rotating knives is lifted mechanically through a vertical tower against a counterflow of water.

Mexican sugar cane crop, 1962[3].—Although the cane crop was 2·9% bigger in 1962 than in the previous year the increase was less than had been expected. Of the total cane area of 331,925 ha, a little less than 90% was harvested, compared with 92% of the 1961 area of 312,786 ha. Production of sugar cane was 15,765,050 Spanish tons, some 3% greater than in the previous season, when the yield was 53·3 tons/ha compared with 52·8 in 1962. More than half of the crop was produced in the states of Veracruz and Sinaloa. Sugar production is estimated[4] at the record figure of 1,673,548 tons, compared with 1,522,032 tons in the previous crop.

* * *

Beets to be grown in Texas and New Mexico[5].—The U.S. Dept. of Agriculture announced on the 18th December 1962 that 22,230 acres were to be committed from the National Sugar Beet Acreage Reserve to farms in counties of Texas, and 2500 acres to farms in New Mexico. This commitment is expected to yield about 50,000 tons of sugar in the 1964 crop for the proposed factory to be built by the Holly Sugar Corporation near Hereford, Texas.

[1] *Australian Sugar J.*, 1962, **54**, 457.
[2] *Tate & Lyle Times*, January 1963, p.13.
[3] *Bol. Azuc. Mex.*, 1962, (160), 39–30.
[4] *Echo de la Bourse*, 7th November 1962.
[5] *Lamborn*, 1962, **40**, 255.

Institut für Landwirtschaftliche Technologie und Zuckerindustrie an der Technischen Hochschule Braunschweig

Director: Prof. Dr. F. SCHNEIDER

AN advanced training course for sugar technologists is held during each summer term at the Braunschweig Sugar Institute.

The course is attracting more and more attention from foreign sugar industries, and sugar technologists from Afghanistan, Greece, Iraq, Austria and Persia as well as men from Federal Germany took part in the summer 1962 course. The main part of the course consisted of lectures and classes as well as practical work in the individual departments of the Institute. Lectures and practical exercises were held on the following subjects:

Prof. Dr. F. Schneider: Chemistry and technology of sugar production ; Chemistry of carbohydrates.

A discussion on sugar technology: with Prof. Dr. R. Weidenhagen, Dr. A. Emmerich and Dr. E. Reinefeld.

Prof. Dr. H. Lüdecke: Sugar beet and sugar beet agriculture.

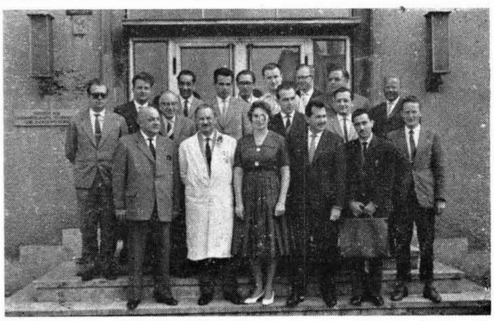
Prof. Dr. R. Weidenhagen: Chemistry and technology of juice purification in sugar production.

Dr. A. Emmerich: Analytical factory control in the sugar industry.

Dr. E. Reinefeld: Extraction processes in sugar production.

Juice extraction and purification, analytical factory control, sugar house operation, microbiology, waste water problems, etc. were dealt with in very great detail in the classes. The laboratory work fully supplemented the lectures and classes.

A course of instruction on measurement and control techniques was held in the lecture hall of the Institute under the guidance of the firm of Siemens. A large number of sugar technologists from various German sugar factories took part.



Institut für landwirtschaftliche Technologie und Zuckerindustrie

During a five-day tour through Southern Germany, visits were paid to a sugar factory, sugar processing works and to suppliers of sugar industry equipment.

College- or university-trained chemists or engineers are admitted.

BREVITIES

U.S. frost damage to cane.—An official of the American Sugar Cane League is quoted[1] as saying that the severe freeze of December 13th froze the inside and split the stalks of a good part of the 15% of the cane crop still unharvested. Some of the frozen cane has been diverted to mills that had just finished grinding their own crops and will have been salvaged. Nevertheless the damage is sufficient to cause a reduction in the Louisiana sugar crop estimate from 487,000 tons to between 450,000 and 475,000 tons. The Florida industry has suffered greater losses because some new mills are not yet ready to crush; furthermore, the Florida crushing season was just getting under way and further growth and ripening of young cane will have been adversely affected. The Commissioner of Agriculture in Florida estimates that production will be reduced from 500,000 tons to 350,000 tons[2].

* * *

Cane diffusion in Tanganyika[3].—A D.d.S. continuous diffuser has been made for the Arusha Chini sugar factory of Tanganyika Planting Co. Ltd. The diffuser is to be installed between the second and third mills of the four-mill tandem, and will be supplied with water heated to 160°F. It is hoped that 2% more sugar will be extracted from the cane, although more impurities will be extracted also and there will be the problem of drying the bagasse sufficiently to use in the boilers, and an increase of about 15% in the load on the evaporators.

* * *

Mackay bulk terminal extension[4].—Work has been speeded up on the £1,000,000 extensions to the Mackay bulk sugar terminal and it is now anticipated that the new storage shed will be in operation by the middle of October next. Work is well under way on the foundations and concrete floor of the building and tenders have been called for the supply of structural steel and roofing. The new buildings will provide storage for an additional 100,000 tons of sugar bringing the total capacity to 250,000 tons and making the Mackay terminal the largest of its kind in Queensland.

* * *

Beet sugar study in New Zealand[5].—A study of the economic possibilities of a project to establish a beet sugar industry in South Otago, South Island, New Zealand, is being made by the South Otago Investigation Company, to the board of which Mr. B. H. AMES, Managing Director of the New Zealand Sugar Company, has been appointed. The New Zealand Sugar Co. is a subsidiary of the Colonial Sugar Refining Co Ltd.

* * *

Alcohol distillery in Argentina[6].—Six kilometres from Mar del Plata, on the road to Necochea, a distillery is being built for the production of alcohol from beet. The plant, belonging to the company Del Sud S.A.C.I.F.I.A., will have a production capacity of 14,000 litres of alcohol per day, using for this between 100 and 120 tons of beet. The cost is estimated at 100 million pesos.

* * *

New sugar mill in Uruguay[7].—San Javier Sugar Cooperative, in Misiones Province, Uruguay, has started crushing at a daily capacity of about 500 tons of cane per day, producing 50 tons of sugar and 20,000 litres of alcohol. All the machinery and equipment for the mill has been imported from Brazil.

* * *

Puerto Rico sugar crop, 1962[8].—The 28 Puerto Rican sugar factories crushed a total of 9,663,265 tons of cane in the 1962 crop to produce 996,626 tons of 96° sugar. Average sugar content was 10·314% on cane.

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1 *Willett & Gray*, 1962, **86**, 520.
2 *Public Ledger*, 12th January 1963.
3 *Producers' Review*, 1962, **52**, (12), 47.
5 *Queensland Newsletter*, 31st January 1963.
4 *Commonwealth Producer*, 1963, (393), 33.
6 *La Ind. Azuc.*, 1962, **58**, 317.
7 *Sugar y Azúcar*, 1962, **57**, (12), 66.
8 *Sugar y Azúcar*, 1962, **57**, (12), 74.

BREVITIES

Government support for the British Honduras sugar industry[1]. Until recently it had been the British Honduras Government's intention not to encourage increased sugar cane acreage in the north of the Colony. Because of a heavy infestation of froghopper and the discovery of a disease in the cane, the Government's plans have changed, according to the Minister of Natural Resources, Commerce & Industry in a radio broadcast. To meet immediate needs in bringing production to a higher level, the Government has underwritten a loan of $200,000 to the Cane Farmers' Association which will cover the cost of cleaning the fields and the purchase of fertilizer and insecticide to combat the froghopper. The present cane variety will be replaced by disease-resistant and higher-yielding varieties, the Government providing the necessary seed material to farmers. Increased acreage will be needed and it is the Government's intention to release as soon as possible the 3000 acres available in the Pachacan-Xaibe-Calcutta area.

* * *

Greek sugar beet acreage for 1963[2].—The area sown to beet seed for the 1963/64 campaign is expected to be 105,000–110,000 stremmas (26,000–27,000 acres). This is a reduction on the original area proposed and is due to the fact that the Platy sugar factory will again have to work on a trial basis following the discovery of defects in the factory during its first trial run this campaign.

* * *

Indonesian factory building loan from Poland[3].—The Polish export agency CEKOP and the Indonesian Government have signed an agreement concerning a loan which will be granted by Poland for the construction of a sugar factory near Tjot Girek. This is to have a capacity of 2000-2500 tons of cane per day and is to begin production in 1965.

Stock Exchange Quotations

CLOSING MIDDLE

London Stocks (*at 18th February* 1963)

Anglo-Ceylon (5s)	14/1½
Antigua Sugar Factory (£1)	6/–
Booker Bros. (10s)	24/6
British Sugar Corp. Ltd. (£1)	25/3
Caroni Ord. (2s)	4/–
Caroni 6% Cum. Pref. (£1)	14/6
Distillers Co. Ltd. (10s units)	32/9
Gledhow Chaka's Kraal (£1)	64/–
Hulett & Sons (R1)	38/6
Jamaica Sugar Estates Ltd. (5s units)	4/7½
Leach's Argentine (10s units)	16/–
Manbré & Garton Ltd. (10s)	46/–
Reynolds Bros. (£1)	17/–
St. Kitts (London) Ltd. (£1)	11/–
Sena Sugar Estates Ltd. (10s)	9/10½
Tate & Lyle Ltd. (£1)	47/6
Trinidad Sugar (5s stock units)	4/–
United Molasses (10s stock units)	33/3
West Indies Sugar Co. Ltd. (£1)	14/6

CLOSING MIDDLE

New York Stocks (*at 16th February* 1963)	$
American Crystal ($10)	46
Amer. Sugar Ref. Co. ($25)	50
Central Aguirre ($5)	23⅞
North American Ind. ($10)	15½
Great Western Sugar Co.	39
South P.R. Sugar Co.	39⅞
United Fruit Co.	27¼

ICUMSA

In our issue of January 1963 we stated that the next Session of the Commission would be held in Copenhagen and that the tentative date was the end of May, 1966. We have been advised by Prof. J. DUBOURG, President of ICUMSA, that this information, which was not supplied by the President or new Secretariat, is not correct since the venue and date have not yet been decided.

United Kingdom Imports and Exports

BOARD OF TRADE RETURNS[4]

Tons	1962	1961
IMPORTS—		
Refined	102,237	221,641
Raws—		
Mauritius	403,082	355,487
Australia	437,548	331,954
Fiji	96,503	94,991
Jamaica	209,490	152,438
Leeward Is.	40,226	47,828
Windward Is.	5,196	3,954
Barbados	115,848	101,810
Trinidad	128,492	118,873
British Guiana	145,073	130,343
Other British	17,190	17,661
TOTAL COMMONWEALTH	1,598,648	1,355,339
South Africa	185,602	203,445
Cuba	117,359	83,357
San Domingo	7,991	226,667
Peru	—	5,036
Brazil	—	20,801
Other Foreign	136,459	166,907
TOTAL FOREIGN	447,411	706,213
GRAND TOTAL RAWS	2,046,059	2,061,552
EXPORTS—Refined—		
Cyprus	9,659	5,798
Sierra Leone	12,249	13,849
Ghana	21,048	29,444
Nigeria	31,668	37,637
Tanganyika	3,549	5,061
Kenya	21,823	14,593
Bahrein, Qatar & Trucial States	500	2,822
Kuwait	776	2,889
Singapore	1,136	3,681
Malaya	18,507	12,574
Other Commonwealth	13,687	17,952
Norway	57,186	59,167
Western Germany	19,936	41,425
Netherlands	22,453	378
Switzerland	36,211	18,525
Tunisia	19,676	7,884
Saudi Arabia	414	1,589
Iraq	1,304	32,772
Other Foreign	20,880	13,208
TOTAL	312,662	321,248

[1] *Chron. B.W.I. Comm.*, 1962, **77**, 633.
[2] F. O. Licht, *International Sugar Rpt.*, 1962, **94**, (12), 195.
[3] F. O. Licht, *International Sugar Rpt.*, 1962, **94**, (12), 200.
[4] through C. Czarnikow Ltd., *Sugar Review*, 1963, (594), 30.