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THE
INTERNATIONAL SUGAR JOURNAL

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NOTES AND COMMENTS

International Sugar Council

The Nineteenth Session of the International Sugar Council was held at the Seat of the Council in London on 28th and 29th April 1965. The Session was presided over by Mr. J. O'MAHONEY, of the Republic of Ireland, the Chairman of the Council for 1965.

The Council resolved as follows:

(*a*) to authorize the Executive Director to request the Secretary General of the United Nations to summon a conference in the autumn of 1965 to initiate the negotiation of a new International Sugar Agreement and also, if it proved necessary, to make arrangements for a final conference to be concluded not later than 31st March 1966;

(*b*) to request the Executive Director to prepare the draft of such an Agreement for circulation to member Governments and subsequently to the United Nations as a basis for negotiation;

(*c*) in order to assist him in the work of drafting, to authorize the Executive Director to consult Governments and any other interested organizations either individually or in groups; and

(*d*) to invite the Executive Director to offer facilities for informal meetings of importing and exporting members.

The Session was attended by representatives of forty-four countries, by a governmental observer from Honduras and observers from the E.E.C., the F.A.O. and the International Bank for Reconstruction and Development.

The Council approved applications for accession to the 1963 Protocol by Sierra Leone and Honduras. Accession by these countries would bring the total membership of the Council to forty-eight countries.

The Council adopted a revised estimate of the minimum net import requirements of the world market in 1965 made by its Statistical Committee on the basis of official figures and, where these were not forthcoming, on its own assumptions. On that basis minimum net import requirements of the free market for 1965 were now estimated to amount to 11,775,000 metric tons, raw value; import requirements of the United States of America from foreign sources were now estimated at 3,300,000 metric tons, raw value, making a total for the net import requirements of the world market of 15,075,000 metric tons. The Council also agreed to revert to the practice followed in the past of making provision for an allowance of 2% for possible underestimates, supplies for ships' stores and unexplained disappearance of sugar. Thus the revised estimate puts world requirements at 15,376,000 metric tons, raw value. The Council considered this estimate (details of which appear elsewhere in this issue) against the latest forecast of total supplies likely to be available for export to world destimations in 1965, and noted that, while supplies continued to appear to be in excess of estimated requirements, stocks remained well below the high levels reached in 1961–1962.

Commenting on the prospects for a new Agreement, C. Czarnikow Ltd.[1] aver that:

"There can be no doubt that, whatever the long-term advantages it may afford, an International Agreement will call for some immediate sacrifices on the part of both importers and exporters. The prevailing world market price for sugar is well below the cost of producing the commodity in any country in the world and one of the matters which importers will be expected to consider is the range of prices they would be willing to pay, subject to the establishment by exporters of the necessary safeguards to prevent values from rising above such a price band. At present the greater proportion of sugar which crosses national frontiers does so within specific trade arrangements and regional agreements at prices which offer a return to the grower well in excess of world market values. It may be unreasonable at this stage to expect some of the poorer importers to agree to pay the 5.00c to 6.00c per lb at which sugar within these trade pacts changes hands but clearly an improvement from current levels is called for.

"It is doubtful if there can be a sustained improvement from today's prices so long as the present statistical situation obtains. The long term objectives of any Agreement which is to be a success either morally or economically must include plans for an expansion in consumption, particularly in those

[1] *Sugar Review*, 1965, (711), 83.

areas where the vast majority of the population suffers from under-nourishment, and it is to be hoped that this aspect of the situation is borne in mind by those who during the next several months will be examining the problems caused by the imbalance between supply and demand. More immediate measures are likely to involve the establishment of quotas by exporting countries, however, and it is here that difficulties seem likely to arise. Considerable capital has already been invested in expansion schemes in many parts of the world and the time factor for the regulation of the cane industry is always longer than the three to five year period of an Agreement. Under the circumstances it seems probable, therefore, that the countries concerned will seek quotas in excess of their current export performances. How such claims can be accommodated when the current situation is already so out of balance remains to be seen, but it may be possible to work out some arrangements to include deferred quotas which will become operative only after consumption has risen. Certainly sacrifices will be called for on the part of exporters if a balance is to be struck, but at the same time it is conceivable that importers would be willing to give an undertaking to limit the area of their own crops to current levels or below; it would not, of course, be realistic to ask them to put a tonnage figure on their production as this, particularly in the beet producing countries, depends so very much on weather conditions."

* * *

South African sugar production.

Sugar production for the 1964/65 crop is now finally put at 1,395,446 short tons, compared with 1,264,704 tons in 1963/64. This is a record production figure despite the low level of rainfall during the period November-February, which, according to the South African Sugar Association, was the lowest at 12·34 inches since the summer of 1925/26. The rate of evaporation recorded at the Experiment Station was the highest since the figures were first recorded.

According to the first official estimate of the South African Sugar Association, South Africa's sugar production in the 1965/66 season should amount to around 1,100,000 short tons, a drop of 295,000 tons from the outturn in the previous season. It had originally been anticipated that, following the expansion of the cane area, a crop of more than 1,500,000 tons would have been produced had there been normal rains and arrangements had been made on this basis to dispose of the tonnage expected to be available for export.

The severe drought, the worst for forty years, has hit the cane crop reducing the supply for the sugar factories and causing delay of new plantings. The situation might worsen if the drought continues, and the crop might be reduced below the present estimated level. The Association has emphasized, however, that there is no question of a shortage of sugar for the domestic market, and, in order to ensure that South Africa can meet export contracts for sugar of South African origin, the industry is to import 105,000 long tons from the Dominican Republic, Mauritius, Brazil and Thailand.

* * *

Reduction in U.K. sugar surcharge

The Sugar Board surcharge of 4d per lb (37s 4d per cwt) was reduced to $3\frac{3}{4}$d per lb (35s 0d per cwt) on 28th April and to $3\frac{1}{8}$d per lb (32s 8d per cwt) on 14th May, 1965. The changes in surcharge, which resulted in an overall reduction of about 4s 8d per cwt in the ex-refinery price, was made to bring the Sugar Board's trading position more into line with the current level of world price.

* * *

World sugar consumption.

Some recently published statistics[1] show that while slight increases in sugar consumption have occurred in Western Germany, France and Belgium, the consumption in 1964 was lower in Holland and Denmark than in 1963 and particularly so in the U.K. (a decrease of 7·31%). The reasons are basically to be found in diet rather than in economics. In the U.S., where consumption has decreased by 3·83%, there has been increased use of synthetic sweeteners. South Africa has increased its sugar consumption, and, surprisingly enough, so has Australia (by 3·03%), which is one of the highest sugar consuming countries in the world. The sugar consumption in India and Brazil is considerably decreasing owing to lack of stable economy and to political circumstances.

* * *

Antigua sugar industry commission of inquiry.

Following a conference at the Colonial Office in London which ended on the 5th March, H.M. Government and the Government of Antigua, in consultation with the Antigua Sugar Factory Ltd., agreed that a Commission of Inquiry should be set up at an early date to investigate the economics of the sugar industry in Antigua. A further announcement will be made shortly as to the composition and detailed terms of reference of the Commission.

In the meantime arrangements have been made for the reaping of the 1965 crop and the continuation of the industry.

In view of the importance of increasing the available water resources, H.M. Government and the Government of Antigua have agreed that water conservation measures should be a first priority in the use of development funds in Antigua. H.M. Government will agree to the application of $1,500,000 to schemes to be approved for this purpose out of funds which will, subject to Parliamentary approval, be made available to the Government of Antigua under the Colonial Development and Welfare Acts. These schemes will be starting in 1965.

[1] F. O. Licht, *International Sugar Rpt.*, 1965, **97**, (7), 1–2.

SUGAR CANE RESEARCH IN MAURITIUS

Mauritus Sugar Industry Research Institute Annual Report, 1963. 153 + 32 pp.

THE Sugar Industry Research Institute of Mauritius has completed its first decade of active work, for it was started in 1953. During this period the production of sugar cane and sugar throughout the island has increased considerably. This is well illustrated by the coloured diagram on the cover of this report, which depicts area cultivated, yields and sugar production from 1954 to 1963. It is pointed out that production or yield has risen in spite of the fact that lands brought under cultivation in recent years have generally been of low potential—very rocky or situated under unfavourable climatic conditions.

Production rose from 491,000 tons in 1954 to 682,000 tons in 1963 and yields from 2·94 tons per arpent* to 3·50 tons, which is a creditable performance and must be a source of great satisfaction to producers and to the Research Institute which has provided so much guidance.

Varieties

Eight major sugar cane varieties were in cultivation in Mauritius during the year, four of which showed an increase in the area under cultivation compared with the previous year. In areas planted during 1963 four varieties accounted for more than 80% of the planting, these being M147/44, M93/48, M202/46 and Ebène 50/47, the last mentioned scoring the highest individual yield.

The characteristics and performance of some new, unreleased varieties are discussed. One of the most promising of these is M442/51. This is a vigorous, erect variety with yellowish stalks of thin to medium size. Its qualities include—vigour, good ratooning, easy trashing and high resistance to cyclones. On the debit side it has a low sucrose content and is very highly susceptible to chlorotic streak. The variety is late maturing and it is emphasized that it should not normally be reaped at the beginning of the crop.

Arrowing

Most varieties of cane arrowed or flowered profusely during 1963. The good weather conditions that favoured cane growth seemed also to increase the number of flowering canes. It was found, in the two varieties tested, that ratoons tend to flower more than plant cane and that a higher arrowing intensity appears to occur at the edges of fields than in the centre. The significance of these differences has not yet been tested but both results seem to confirm general beliefs about flowering behaviour and are derived from counts on many thousands of canes. The effect of date of previous harvest on flowering intensity has been found to vary with the different commercial varieties grown.

Breeding

The profuse flowering rendered possible a wide crossing programme, over 1000 crosses being made. About 200 parent varieties were used in different combinations. Interesting results were obtained in the cubicles of the new greenhouse constructed the previous year. The ripe fuzz was dried and stored in a deep freezer until sown 3 months later. Seedlings at the rate of 176 per arrow were obtained.

Details are given of variety and pre-release trials and individual descriptions of the more promising varieties.

Diseases

A good growing season, with absence of cyclones, has not been conducive to the unusual in the pathological field. The two major bacterial diseases, gummosis and leaf scald, although present in 2 collections of old varieties, have disappeared from commercial plantations, thanks to efficient screening. Red rot and smut have assumed minor importance through the cultivation of resistant varieties. Chlorotic streak and ratoon stunting disease continue to be the two major pathological problems which the industry has to face. With regard to the last mentioned, disease indications are that the variety M253/48 may be the least susceptible of the newer varieties.

With regard to chlorotic streak, as evidence of soil transmission builds up more attention is being paid to the production of resistant varieties. In a resistance trial the present 8 commercial varieties all contracted infection within a year. A certain number of apparently resistant varieties seem to have been found among more than 100 tested.

An account is given of the progress made in controlling or reducing the effects of Fiji disease in Malagasy (Madagascar), mainly by the planting of resistant varieties, notably Pindar.

Insect Pests

Damage from the red locust (*Nomadacris septemfasciata*) was severe in places and had to be countered by the use of insecticides. The red locust may have been favoured by cyclones in recent years, in that many Indian Mynah birds (*Acridotheres tristis*) were destroyed. These were purposely introduced as long ago as 1763 as a locust predator.

The army worm (*Leucania loreyi*) was also troublesome in 1963. Remedial measures are suggested. Studies on the sugar cane scale insect (*Aulacaspis tegalensis*) and stalk moth borer (*Proceras sacchariphagus*) were continued, parasites for the latter having been imported from India for observation.

* 1 arpent = 1·043 acres.

The appearance in Mauritius of the notorious rhinoceros beetle (*Oryctes rhinoceros*), a major pest of coconuts, which may also feed on sugar cane stalks, is recorded.

Cane Germination

Studies were continued on the possible effect of different growth substances on germination of variety M93/48 using 3 types of cutting—top, middle and bottom of stem. Gibberellic acid, arginine and sodium nitrate were used at various concentrations. None improved germination of bottom cuttings. Top and middle cuttings were stimulated at some of the concentrations used.

Herbicides

During 1923 10 trials were conducted to compare the effectiveness of substituted ureas versus substituted triazines. DCMU gave consistently better results than CMU and the two substituted triazines "Simazine" and "Atrazine". Another 10 trials were carried out to test the effects of "Dalapon", "Paraquat" and "Fenac", applied to first ratoons after harvest.

"Tordon", a derivative of picolinic acid, proved slightly less effective than DCMU at equivalent dosages but proved toxic to sugar cane growth at all concentrations used (5·0–0·7 lb). "Cotoran" was comparatively less effective than DCMU and had no adverse effects on cane growth. The two substituted triazines "Ametryne" and "Prometryne" gave very similar results but proved, in general, to be less effective than DCMU.

Soils and Irrigation

With the heavy dressings of nitrogenous fertilizers now used in Mauritius (an increase of 12 kilos per arpent since 1954) the soils are being slowly acidified. Because of this increasing acidity a study was made of the calcium and magnesium status of cane growing soils over the whole range of soil and climatic conditions in Mauritius. The results are presented in this report and show that calcium and magnesium levels are generally satisfactory. A study was also made of the manganese and silica levels of leaf-sheaths, a wide variation being apparent in different soils.

A survey of cane areas under irrigation was carried out during 1963. It showed the total area irrigated to be 28,500 arpents. Some 30% of this was by overhead irrigation, the remainder by furrow. Some 30% growers in Mauritius are becoming increasingly conscious of the value of complementary irrigation. The Research Institute is often approached for advice on the installation of irrigation schemes. It is considered that better utilization of water resources, both surface and underground, would result in a significant increase in the island's sugar production. Six lysimeters were installed by the Research Station to study the consumptive use of water in relation to soil and climatic factors. Recording of data began in June 1963 and is planned to cover 3 years.

Climatic Map

The Research Institute is planning the publication of a detailed climatic map of Mauritius, with the co-operation of the Meteorological Services. It is felt such a map should improve the understanding of the various ecological conditions which obtain in Mauritius, especially for areas devoted to sugar cane cultivation and experimentation. The scale of the map will be the same as that of the soil map already available. It will follow the world-wide system of classification of climates elaborated by THORNTHWAITE in 1948.

F.N.H.

SUGAR CANE BORERS IN INDIA

Experiments with imported parasites

AN account has been given[1] of an attempt to introduce Tachinid parasites into India for the control of lepidopterous sugar cane borers, against which insecticides and the previously introduced parasites *Trichogramma minutum*, *Telenomus beneficiens* and *Isotima javensis* have in general proved unsatisfactory. Consignments of the Tachinids, which comprised *Metagonistylum minense*, four strains of *Lixophaga diatraeae* and two of *Paratheresia claripalpis* were received from Trinidad during 1959-60. The methods adopted by the authors (G. MOHANRAJ and A. P. SAXENA) for rearing laboratory stocks are described, and the results of trials with alternative hosts given, as well as notes on the duration of development of each parasite in the laboratory.

The work was carried out at Bangalore, where the principal borer is *Scirpophaga nivella*, and it was seriously handicapped by difficulty in obtaining sufficient numbers of borers of different species at times when they were required. Some adults of *Paratheresia claripalpis*, *Metagonistylum minense* and the Antiguan and Jamaican strains of *Lixophaga diatraeae* were liberated when none was available. In February 1960 importation of parasites from Trinidad was discontinued, and attempts, which proved unsuccessful, were made to build up laboratory stocks at four research stations in the north, where it was hoped to breed strains suited to the chief host species present in different areas.

In view of the recent establishment of the Cuban strain of *Lixophaga diatraeae* in Taiwan, where it attacked *Proceras venosatus*, *Chilo infuscatellus* and *Sesamia inferens* in the greenhouse and gave 9·8, 32·6 and 11·4% parasitism, respectively, in the field, a small stock of the strain was obtained from Taiwan and work with it is in progress.

F.N.H.

[1] *Tech. Bull. Commonwealth Inst. Biol. Contr.*, 1964, (4), 43–61 (3 figs., 31 references); through *Rev. Appl. Ent.*, 1964, **52**, Ser. A, 400.

SPRINKLER IRRIGATION IN MOZAMBIQUE

THE average annual rainfall at Luabo in Mozambique is only some 45 inches of which 82% (37 inches) falls in November to April. The remaining six months receive less than 8 inches of rain and September and October are not infrequently completely dry. Not only is this rainfall inadequate for optimum cane yields but the long dry period severely retards the re-establishment and growth of ratoons. The soils are fertile, however, and of good characteristics, and the seasonal temperature range is ideal for the production of high quality cane. Irrigation can clearly do much both to improve yields and to even out productivity.

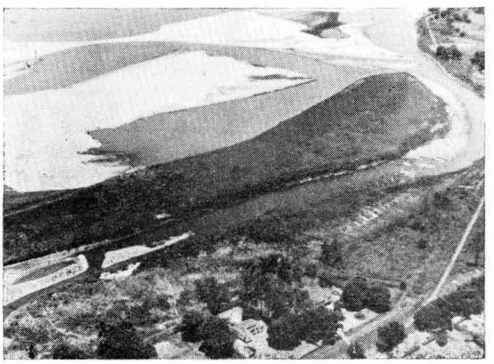
The introduction of surface irrigation would involve considerable modification to the existing field pattern, a great deal of earth moving, resulting in disturbance to the fertile top soil, very great care in the handling of water, and a higher capital cost than sprinkler irrigation. In addition, the water usage of some 25% higher than with sprinkler irrigation would undoubtedly aggravate the drainage problems which already exist on the estate. Of greater immediate importance to the estate is the fact that an overhead sprinkler irrigation scheme cane be imposed on the existing field layout with a minimum of disturbance—and results can be obtained immediately the installation is complete.

Sena Sugar Estates Ltd. carried out extensive tests with irrigation equipment from manufacturers all over the world and decided that Wright Rain Ltd., of Ringwood, Hampshire, with its considerable world-wide experience of cane estate irrigation, was best fitted to carry out the work of installing the irrigation equipment and services. A contract totalling £1,700,000 was therefore awarded to Wright Rain; it is the largest contract for irrigation equipment ever awarded to a British exporter and is believed to be the largest such contract ever awarded for a single sprinkler irrigation scheme anywhere in the world.

The contract is for a system to cover 16,600 acres of sugar cane which will use 120 million gallons of water a day—as much as the daily water requirement of a city of 3 million people. Some of the equipment to be used is to be supplied by Portuguese firms but over £1,000,000 worth of equipment is to be provided from Britain. Power will come from two English Electric turbo-charged diesels, a telephone system is to be installed to connect each pump station, 7000 sprinklers will work 23 hours a day, and there will be 170 miles of portable aluminium piping and 20 miles of irrigation canals.

In surveying the estate to prepare the scheme a total of 102,000 miles was travelled in six months, and a further survey is being carried out on the Sena estate at Marromeu, where it is probable that another 14,000 acres of sugar cane will need to be irrigated, requiring a further 100 million gallons per day.

At Luabo, to meet the economically acceptable optimum water requirements of the crop the irrigation scheme is designed to apply 7½ inches of water per month, after making due allowance for evaporation losses. Only the River Zambezi has the quantity and quality of water required for irrigation on this scale. At Luabo the Zambezi is a mile wide and is prone to flood severely every year with resultant changes in course and the shifting of substantial sandbanks, seen in the illustration. The river level is subject to variations of up to 27 feet during the year and obviously a river of these characteristics is not an easy one from which to pump large quantitites of water.



It was decided to abandon the idea of any permanent pumping station and instead to mount the pumps on the river itself, in 60-ft long barges. Four of these are to be sited in two different locations and the discharge pipes from their 16 pumps will be connected to the river banks by means of ball and socket joints which will permit the rise and fall of the barges in harmony with the variations in the river level.

The water is then distributed through a canal network bringing every part of the irrigation area within two miles of the irrigation water. The canal width varies from 32 ft near the Zambezi to 6 ft at the far end, and constant upstream level gates are to be installed at appropriate points to control the very large quantity of water flowing in the canals.

The nature of the soil on the estate—it is largely a heavy black Montmorillonite clay—lends itself to earth canals without the need to line them with impervious materials. The slope of the canals is gentle—1 in 5000—and water velocities can be kept low. At suitable points along the canal routes, take-off points lead to small balancing reservoirs which also serve as desilting basins. The irrigation pumps throughout the estates will be of the horizontally split centrifugal type directly coupled to electric motors. These units are mounted in pump stations

adjacent to the balancing reservoirs and discharge into asbestos/cement pipelines which feed the cane fields. The discharge of each pump is measured on flow recording charts to give the estate management the closest possible control of the irrigation applications.

The pipelines run between adjacent fields and 4-inch hydrants are positioned to enable 3-inch sprinkler lines to be laid in the fields on either side. Five such hydrants feed each pair of 30-acre fields. Each sprinkler line is 1170 feet long and has 20 valved outlets at 60-ft intervals. These valve outlets open automatically when a riser pipe carrying a Wright Rain "Lancer" sprinkler is inserted, and close again when the riser pipe is removed. Ten "Lancer" sprinklers on 8-ft high riser pipes (which can be extended to 12 ft as the height of the cane increases) are fitted to each sprinkler line at alternative valve positions.

After 11½ hours' operation the sprinklers will have applied 2½ inches nett; they are then moved to the unused valve positions where they operate for a further 11½ hours and apply the 2½ inches of water to the intervening spaces, thus giving in the 23 hours of operation the whole 2½ inches to 2 acres. The sprinkler line is moved to another position 80 ft away at the end of the 23 hours (this takes up to 1 hour according to the height of the cane) and the cycle is repeated. In ten days of operation each line will apply 2½ inches of water to 20 acres, and this is repeated twice more every 30 days to give the required 7½ inches per month. After the initial shakedown period the labour force required to operate the irrigation equipment will amount to one man per 50 acres.

At present plant cane yield is of the order of 30 tons per acre on a 15-month crop, reducing in ratoons. When the irrigation system has been established, it is anticipated that the yield will be raised to 50–60 tons per acre on a 12-month crop for plant cane and that there will be no more than a slight drop from this level with ratoon cane.

AGRICULTURAL ABSTRACTS

Let's decrease the losses (with sugar beet). R. DUSH. *Sugar Beet J.* (Michigan), 1964, **28,** (1), 4–5.—The writer contends that with so much more care on seed selection and cultivation more care is needed, and less rough handling, in getting sugar beets from field to factory. He states "Along with rough handling comes poor topping, stones, trash and real estate"!

* * *

Sugar cane borer control by parasites. C. B. CHEN. *J. Agric. Assoc. China*, 1963, (44), 1–8; through *Hort. Abs.*, 1964, **34,** 616.—Among 5 parasites from India *Goniozus indicus* and *Sturmiopsis inferens* showed promise for the control of *Sesamia inferens* and *Chilotraea infuscatella*. The egg parasite *Trichogramma australicum* gave good control of *Eucosma schistaceana*, *C. infuscatella*, and *Proceras sacchariphagus* in 8 years' trials. Other unsuccessful introductions are also described.

* * *

Critical period for controlling the sugar cane borer in sugar cane in Louisiana. W. H. LONG and E. J. CONCIENNE. *J. Econ. Ent.*, 1964, **57,** 350–353; through *Rev. Appl. Ent.*, 1964, **52,** Ser. A., 410.—In Louisiana the borer *Diatraea saccharalis* is not normally of importance until the internodes of the cane stalks have begun to form in late June or early July. Results of experiments with "Endrin" granules at different rates and times are given. These showed the need for early summer (June-July) application for effective control.

* * *

Sugar cane in Uganda. ANON. *Ann. Rpt. Dept. Agric. Uganda*, 1962, 13.—Sugar production progressed satisfactorily during the year. A total of 39,473 acres was under sugar cane at the two estates producing white sugar. Total production was 104,300 tons compared with 95,500 tons in the previous year. Exports to Kenya were 35,840 tons compared with 33,001 tons in 1961. There was no export to Tanganyika and 10 tons only to the Congo.

* * *

The effect of potassium chloride on the infestation of sugar beet by beet eelworm, *Heterodera schachtii* **Schmidt.** G. J. CURTIS. *Ann. Appl. Biol.*, 1964, **54,** 269–280.—A high K compound fertilizer (9:4:15 N:P:K) increased sugar beet size and reduced the number of nematode cysts on the roots. The same effects were induced by KCl. With heavy doses of KCl in the field there was little difference between 5 and 10 cwt/acre in root yield and eelworm population. Further work is planned to determine the economic significance of the treatment in beet eelworm control.

* * *

Critical zinc concentrations and leaf minerals of sugar beet plants. R. A. ROSELL and A. ULRICH. *Soil Sci.*, 1964, **97,** 152–167; through *Field Crop Abs.*, 1964, **17,** 269.—A critical Zn level of 8–10 p.p.m. in mature leaf blades confirms previous reports. Zn deficiency was associated with greatly increased contents of Fe, Mn, nitrate and phosphate and to a lesser extent S, in mature blades, but with little change in K, Ca, Mg and Na contents. Zn-deficient sugar beet plants have a lower root and top weight, and, in extreme deficiency, a lower sucrose concentration.

* * *

Nematode control. J. NIEDERER. *Sugar Beet J.* (Michigan), 1964, **28,** (1), 11.—As the sugar beet nematode is becoming more of a problem in Michigan, advice is given on it, under 5 headings, with emphasis on crop rotation and weed control.

The effects of water-table level and salt content of the soil on the growth of sugar cane. F. A. FOGLIATA, P. J. ASO and F. GOMEZ. *Bol. Est. Exp. Agric. Tucumán*, 1963, **93**, 34 pp; through *Soils and Fertilizers*, 1964, **17**, 534.—Sugar cane made good growth in a saline soil when the water-table was deeper than 1·6 m in March-April and deeper than 2·2 m in Dec.-Jan. Growth was poor with corresponding depths of less than 0·8 m and 1·6 m. Soil pH of 7·4–8·1 was satisfactory but 8·5–10 was harmful. Growth was adversely affected when soil chloride + sulphate reached 0·21% and soil carbonate 0·26%.

* * *

Effects of fertilizer placement on the germination and yield in sugar beets. K. OZAKI and S. SAKURABA. *Res. Bull. Hokkaido Nat. Agric. Exp. Sta.*, 1963, (82), 8–15; through *Field Crop Abs.*, 1964, **17**, 270.—On volcanic ash soils in Japan the emergence of sugar beet seedlings was enhanced by placing soluble fertilizer in a single band 2·5–5 cm to the side of the seeds and 6–8·5 cm below them, rather than at corresponding distances of 0–2·5 cm and 1–3·5 cm. Early growth of seedlings and root weight were slightly better where fertilizer was placed below rather than at the side of the seeds, but root shape was irregular.

* * *

On the magnesium manuring of sugar beet. W. WERNER. *Agrochimica*, 1963, **8**, (1), 5–16; through *Field Crop Abs.*, 1964, **17**, 269.—In pot trials with sugar beet, in W. Germany, Mg deficiency symptoms were observed at leaf Mg contents of 0·35–0·37% (dry matter basis). At this level root and sugar yields were reduced. Application of Mg, with or without lime, increased the yield and sugar content of the roots.

* * *

"Phorate" and "Demetron" for control of the pea leaf miner on sugar beets. J. E. DUFFUS and N. F. MCCALLEY. *J. Econ. Ent.*, 1964, **57**, 221–222; through *Field Crop Abs.*, 1964, **17**, 269.—"Phorate" applied at 3 lb/100 lb sugar beet seed prevented leaf damage from *Liriomyza langei* for at least 30 days after sowing. Protection was maintained by 6 side dressings of 2 lb/acre at 18-day intervals, commencing 7 weeks after sowing.

* * *

Observations on the core of sugar beet. L. DECOUX. *Compt. rend. hebd. Séanc. Acad. Agric. France*, 1963, **49**, 443–451; through *Field Crop Abs.*, 1964, **17**, 269. Observations were made (in Tunisia, Morocco and Belgium) after reports of difficulty in slicing unirrigated sugar beet in Tunisia. Autumn sugar beet in North Africa was found to have regularly fibrous roots with hard fibrous cores. Hard cores in Belgium were found mainly in bolting beet. It is suggested that core development, together with long taproots, may be an adaptation for extracting water and salts from deep in the sub-soil, and might be reduced in N. Africa by irrigation.

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Sugar beet seed dressings and damping-off disease in Egypt. M. R. BEKHIT *et al. Agric. Res. Rev. Cairo*, 1963, **41**, (3), 57–64; through *Field Crop Abs.*, 1964, **17**, 269.—Five fungicides to control damping-off were studied. The crop is relatively new and all seed imported. *Pythium* and *Phoma* were found to be common on such seed. Seed treatment with "Ceresan" or "Arasan" (each at 8 oz/100 lb seed) or "Dithane Z78" ("Zineb") at 1–1·5 lb/100 lb seed, increased germination percentage in 3 successive seasons.

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Pre-harvest spraying of sugar beet plants for seed. L. L. OMEL'YANYUK. *Sakhar. Svekla*, 1962, **7**, (12), 21–22; through *Field Crop Abstracts*, 1964, **17**, 268. Spraying of sugar beet crops in their 2nd year with 4% monochloracetic acid or 5% magnesium chlorate, at 400–500 l/ha, reduced moisture content of stems and incompletely mature seeds. This aided mechanical harvesting. A 10% solution of monochloracetic acid did not reduce germination.

* * *

Sugar beet growing enquiry in Holland. J. JORRITSMA and J. M. H. STUMPEL. *Meded. Inst. Rat. Suikerprod.*, 1963, **33**, (3), 89–187; through *Field Crop Abs.*, 1964, **17**, 268.—Data are given on management and yield from a survey of 2777 ha. Reasons for the low yields in the province of Groningen compared with Friesland were sought, the average difference being about 6 tons/ha. Virus yellows disease was considered to be mainly responsible, attacking 60% of crops in Groningen and only 15% in Friesland. Other factors favouring the Friesland crop were better crop rotations, finer seedbeds, quicker and more even seedling emergence, and less reliance on casual labour for singling.

* * *

Transpiration studies on sugar cane. –. MARICO. *Bol. Fac. Filos. Cienc. Letras Univ. São Paulo, Ser. Bot.*, 1963, **19**, 5–100; through *Biol. Abs.*, 1964, **45**, (23), 8039.—Four varieties of cane were studied under laboratory and field conditions. Anatomical studies showed that number of stomata may vary with different varieties. Great sensitivity was shown to water and to light changes. Daily study of transpiration at different seasons showed that one variety (Co 209) did not restrict its water consumption, while other

varieties presented a small restriction during the dry season. The variety CB 41–76, with good productivity and relatively small water consumption, appeared to be the best of the 4 varieties.

* * *

Enzymes in sugar cane. K. T. GLASZIOU and J. C. WALDRON. *Austr. J. Biol. Sci.*, 1964, **17**, 609–618. The full title of this paper, emanating from the David North Plant Research Centre of The Colonial Sugar Refining Co. Ltd., Toowong, Queensland, is "The regulation of invertase synthesis in sugar cane; effects of sugars, sugar derivatives and polyhydric alcohols". The extracted enzyme was unstable in solution at pH values below 5·0, but glucose (0·1 m) did not affect stability. The pH of juice was not altered by incubation of tissues in glucose for 8 hours. Treatments which induced a six-fold change in invertase content gave no significant changes in protein nitrogen content of the tissue.

* * *

Herbicide screening trials in furrow-irrigated sugar cane, 1963. S. D. HOCOMBE and B. KALOGERIS. *Misc. Rpt. Trop. Pest. Res. Inst. Arusha* (Tanzania), 1963, **427**, 6 pp.—Results are given of pre- and post-emergence trials with various herbicides on a brown sandy loam soil (pH 7·5–8·2) with cane planted 1–3 inches deep in the bottoms of irrigation furrows (irrigated every 10–14 days). "Bromacil" was more active than the triazines over the long term but reduced crop vigour. The most prevalent weed, *Portulaca oleracea*, was moderately susceptible to all treatments. *Solanum nigrum*, which heavily infested control plots, was highly susceptible to all the herbicides tested.

* * *

Studies on sugar cane smut caused by *Ustilago scitaminea*. **II.** S. K. SAXENA and A. M. KHAN. *J. Ind. Bot. Soc.*, 1964, **53**, 61–68.—This is a continuation of earlier work[1] and deals with the effect of relative humidity on spore germination. Optimum germination (chlamydospores) was in 100 % R.H. at 25° and 30°C. With 90% R.H. there was no germination at any of the temperatures tested. Significant differences were observed in percentage germination among spore collections from different localities.

* * *

Sugar beet culture in the Northern Central States. J. S. LILL. *Farmers' Bull.*, (U.S.D.A.), 1964, (2060), 41 pp.—This bulletin deals with all aspects of sugar beet cultivation in one of the four fairly distinct beet growing areas of the United States, viz. the humid area located in the northern central states, the other three areas being the Great Plains area, the Mountain States area and the Pacific Coast area. Diseases and insect pests are dealt with.

* * *

Cane varieties in Louisiana. L. L. LAUDEN. *Sugar Bull.*, 1964, **42**, 328, 334.—The prospect for improved varieties is considered to be better now than at any time in the past. It is considered that a greater degree of resistance to mosaic will be needed. Details are given of some outstanding, but as yet unreleased, new varieties.

* * *

Sugar cane fertilizer experiments in Louisiana in 1963. L. G. DAVIDSON. *Sugar Bull.*, 1964, **42**, 330–334. An account of 8 experiments carried out by the Houma Station is given, 5 of which were rate-of-nitrogen and nitrogen × variety interaction studies. Results are shown in 4 tables. No significant variety × nitrogen interactions with promising unreleased varieties have been found during the last 10 years.

* * *

Causes of low yields on some farms of the VMC district. ANON. *Victorias Milling Co. Expt. Sta. Bull.*, 1964, **11**, (7), 1.—The causes of poor yields on 53 cane farms are analysed. Failure to realize the importance of seed cane selection is regarded as the major cause. Other causes, in order of importance, are: inadequate and late fertilizing, faulty replanting, weeding too late and harvesting over-matured or young canes.

* * *

"Targetmaster" irrigation units. ANON. *Victorias Milling Co. Expt. Sta. Bull.*, 1964, **11**, (7), 3.—An account is given of 3 giant irrigation sprinklers from Hawaii (Hanawai Manufacturing Co. Ltd.) for imported trial on VMC cane fields in the Philippines where drought or lack of soil moisture commonly reduces yields. Descriptions of both models, "pipe-line" and "self-contained", are given, the latter designed to draw water from permanent sumps along the towpath or road. In Hawaii these machines are considered to be the most efficient of all irrigation equipment tested during the last 30 years, and also the cheapest system of its type.

* * *

Importance of magnesium in the culture of sugar beet. ANON. *International Fertilizer Correspondent*, 1964, **5**, (11), Item 829.—Figures are quoted which show impressively the losses in yields of roots and sugar that can be caused by an insufficient supply of magnesium. This fifth major nutrient (after N, P, K and Ca) deserves full attention in the manuring of sugar beet, especially with the extension of sugar beet cultivation now taking place in so many countries.

* * *

Sunflower interplanted with sugar cane. J. MIOCQUE. *Bol. Informativo Copereste* (São Paulo), 1964, **3**, (20), 1 p.—An account is given of an experiment in which sugar cane was interplanted with sunflower which could be harvested, as an oil seed crop, after a few months or long before the cane reached maturity.

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Green manuring of sugar cane with *Crotalaria juncea*. J. MIOCQUE. *Bol. Informativo Copereste* (São Paulo), 1964, **3**, (23), 2 pp.—It is pointed out that sunn or sann hemp grows fast, producing a large quantity of herbage. Figures are given showing the nitrogen available (650 kg) from 100 tons of sunn hemp, also of phosphorus and other mineral constituents.

[1] *I.S.J.*, 1964, **66**, 216.

CANE DIFFUSION IN HAWAII

IN 1958, Silver Engineering Works Inc., in collaboration with the Hawaiian Sugar Planters' Association and American Factors Ltd., installed a pilot diffusion plant for sugar cane at Kekaha Sugar Company on the island of Kauai. The experiment, which was conducted with a modified Silver-D.D.S. slope diffuser[1], similar to those produced by the Danish Sugar Corporation for beet, was successful and promising. From this experiment, however, it was concluded that better results could be achieved with a new and radically different type of machine and, as a result, the Silver ring diffuser came into being.

This equipment was designed by Silver Engineering Works Inc., who have extensive experience in beet diffuser design and have furnished continuous diffusers for most of the beet sugar factories of the U.S.A. and Canada. A small experimental unit, of 4 tons per hour capacity, was built and installed in October 1961 at the Helvetia Sugar Cooperative, Convent, Louisiana. The most important feature of the Helvetia operations were the great reduction in water usage compared with the Kekaha trials. Extraction of 93–94% was achieved at a draught of only 90–95%, compared with 117–126% draught necessary with the Kekaha plant, both figures being for operation without return of press-water. Press-water return raised extraction to 97–98% at Kekaha, but could not be arranged at Helvetia.

In addition, the diffusion juice had a much higher clarity than mixed juice from the mills. Solids in screened mixed juice amounted to 4·8% while the juice from the ring diffuser only contained 0·5% of solids, this reduction being due to the way the bed of cane acted as a filter for the juice percolating through it.

These good results were sufficiently encouraging for the construction of a 500 tons/day unit which was installed at Pioneer Mill Company and went into operation in October 1963. Again, results were encouraging and stimulated the installation of a 3600 tons/day full scale unit (Fig. 1) to handle the entire crop for Pioneer Mill Company. This unit went into operation in September 1964.

It consists essentially of two concentric stainless steel shells separated at the bottom by an annular screen which supports the prepared cane. This assembly is provided with a hydraulic drive so that the cane is transported through the greater part of a circle from the feed to the exit points, and is leached by successive amounts of juice pumped from collection tanks under the screen and returned to the bed of cane through overhead distributors. The cane nearest the exit is washed with water which becomes progressively richer in sugar as it nears the cane inlet, finally emerging as the diffusion juice.

All parts of the diffuser coming into contact with cane, bagasse or juice are constructed of stainless steel or other corrosion-resistant material, while the cane travelling undisturbed in a circular path avoids heavy abrasion as in a cane mill, so that the diffuser will have an extremely long life with a minimum of maintenance.

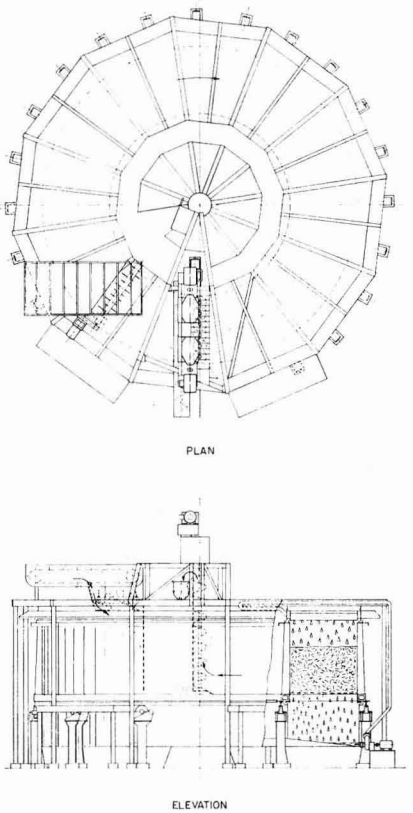


Fig. 1

Cane from the cleaning plant at Pioneer is first fed into a set of revolving knives, over a magnetic separator for the removal of tramp iron and into a hopper. It is then passed successively through a "Cane Buster" and a "Cane Fiberizer", both units designed and manufactured by Silver Engineering Works (which has now become a subsidiary of American Factors Ltd.). Both machines are steam turbine-driven, high-speed, swing-hammer units, capable not only of preparing the cane but also of breaking up large pieces of rock which often enter the factory. The "Cane Buster" makes an

[1] See *I.S.J.*, 1959, **61**, 63, 142.

nitial coarse product which is then reduced by the "Cane Fiberizer" to substantially individual fibres having an average length greater than is produced in milling.

The fiberized cane is conveyed over a weighing device to an inclined belt conveyor which delivers it to the diffuser feed conveyor. After passing through the diffuser the bagasse is lifted out by means of a newly developed vertical scroll elevator and discharged through a chute into a wet bagasse drag conveyor which in turn conveys it to a dewatering press. The bagasse is fed into the press by means of a feed screw which is constructed in such a manner that it gives the bagasse an initial squeeze, thereby removing part of the water before the bagasse enters the press. The screw then forces the bagasse into the press which features two rotating, perforated cone-shaped discs. These discs are mounted at an angle such that their cone surfaces become progressively closer together until the maximum compression ratio is reached at the pinch point. The extracted water passes through the perforated surfaces, through passages behind the discs, and is discharged through the bottom of the press. The disc surfaces then diverge as the bagasse progresses around to the scrapers which clean the disc surfaces and guide the pressed bagasse to the point of discharge. Press-water from the dewatered bagasse is passed through DSM screens before being returned to the diffuser.

Cane flow to the diffuser is controlled by the setting of the weighing device to a given tonnage rate. This automatically controls the power input to the "Cane Buster" which, in turn, governs the speed of the feeder rolls supplying knifed cane from the hopper. The level in the hopper is maintained within set limits by means of a variable speed drive on the cane carrier. Although the normal capacity of the Pioneer unit is 150 t.c.h., it is possible to reduce this to as low as 25% of rated capacity or less without loss of extraction efficiency. Conversely, rotation can be increased and throughput raised above the rated capacity, slightly lower extraction occurring when this is done.

The circulation of juice is shown schematically in Fig. 2. Juice is collected in the tanks below the cane and pumped to the juice distributors above. As shown, the conditions are such that each pump and distributor handles 100% of the juice throughput. The juice distributors are rotatably adjustable, however, so that, with increased or decreased cane capacities, or with changes in percolation rate occasioned by varying amounts of dirt in the cane, the distributor assembly may be advanced or retarded to suit the changed conditions. When operating at low cane throughput (by having a thinner cane bed and/or reducing the speed of rotation), the distributor assembly can be retarded, when part of the juice will be returned above the cane through which it has already passed; in this way each pump will handle more than 100% of the juice throughput. When the diffuser is operated at more than maximum tonnage, or the percolation rate is low, the assembly may be advanced so that juice is advanced more than one stage at a time and each pump will then handle less than 100% of juice throughput. With such adjustments the cane bed can be kept at a maximum fill of juice, with optimum circulation.

The juice from the pump indicated as No. 17 in Fig. 2 is delivered to the head end of the diffuser for distribution on the entering fiberized cane, and is recirculated by pump 18. This recirculation serves to filter the juice which overflows at one end of the final collecting tank and goes to process. The juice from pumps 17 and 18 is heated before re-entering the diffuser in order to heat the fiberized cane to the proper diffusion temperature.

The supply water input to the diffuser is automatically controlled to match the cane flow. It is mixed with the bagasse press-water and heated with injected exhaust steam to a controlled temperature before being fed to the diffuser. The temperature of the juice at appropriate points around the diffuser is also automatically controlled.

Tabulated below are average results obtained at Pioneer during a one-day period and a one-week period

	One day	*One week*
Extraction	97·6	97·4
Draught	100	95·3
Cane pol	12·33	12·6
Cane fibre	13·48	14·13
Bagasse pol	0·77	1·16
Bagasse moisture	9·2	6·9

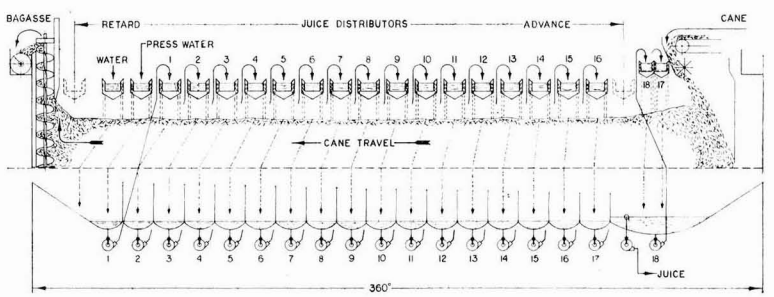


Fig. 2

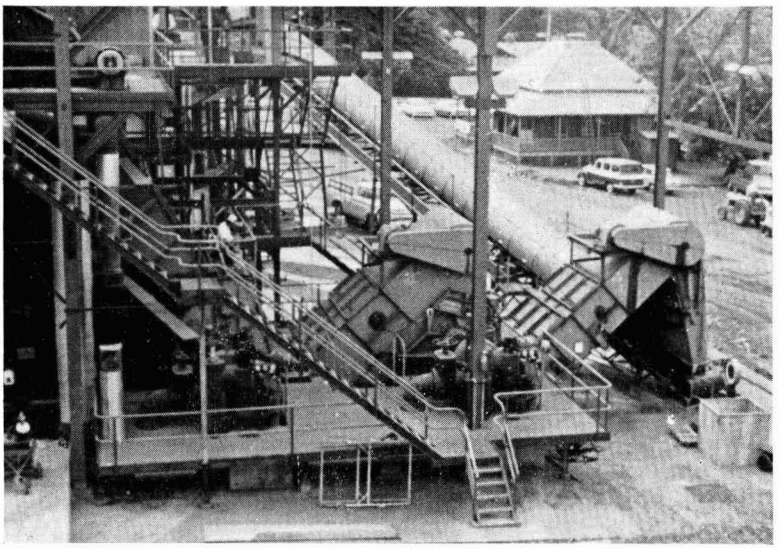


Fig. 3. Cane enters from the left of the picture, feeding first into the "Cane Buster" and then into the "Cane Fiberizer", from which it is discharged via the weigher to the inclined conveyor.

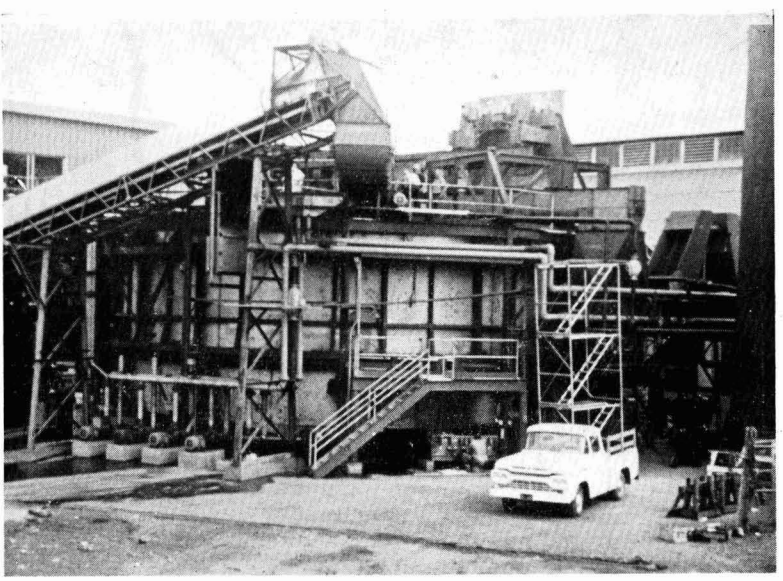


Fig. 4. Cane is discharged at the upper end of the inclined conveyor into the diffuser. The control panel for the hydraulic drive is shown at the base of the unit, to the left of the truck, while the bagasse discharge chute is shown at the upper right portion of the unit.

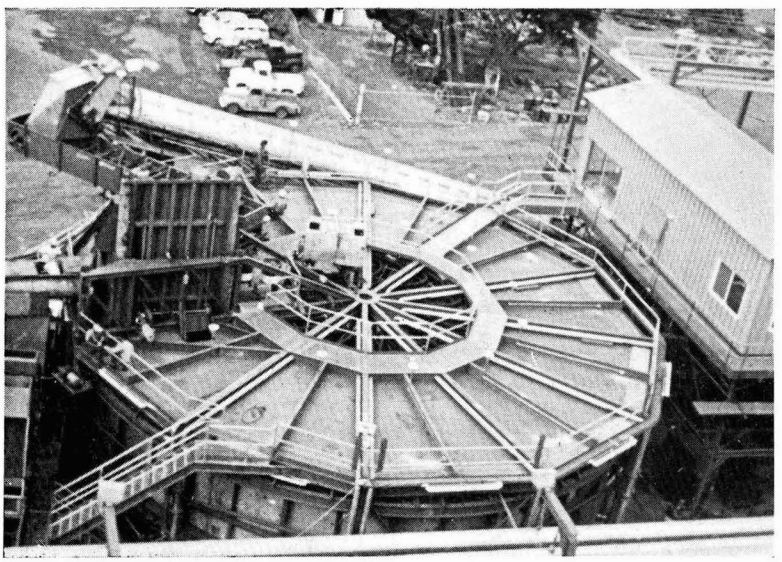


Fig. 5. Top view of the diffuser showing the prepared cane feed point and housing for the bagasse discharge.

KINETIC ASPECTS OF SUCROSE HYDROLYSIS

by K. VUKOV
(Research Institute of the Hungarian Sugar Industry)

SUCROSE hydrolysis has been shown to be a first-order reaction in respect of sucrose, its reaction rate constant being directly proportional to hydrogen ion activity within rather wide limits. On the other hand, views differ as to the dependence of the reaction rate constant on temperature and sucrose concentration; in addition, there is some ambiguity concerning the catalytic effect exercised on the reaction by hydroxyl ions and salts in neutral and alkaline media.

Hydrolysis catalysed by hydrogen ions

Table I shows the activation energies in different temperature ranges, calculated from the displacement of the reaction rate constants with the temperature. The data have been derived from measurements published by a number of authors. They represent average values weighted in inverse proportion to the magnitude of the inherent errors as even the smallest measurement error is liable to cause considerable differences.

Activation energy is, consequently, independent of temperature. The displacement of the reaction rate constant with the temperature may thus be calculated by using the decadic exponent $\frac{5670}{T}$, T being the absolute temperature in degrees Kelvin. (The exponent has been calculated according to Arrhenius' equation.)

Table I

Temperature range, °C	*References*	*Activation energy, kcal/mole*	*Standard error*
20 – 60	(1), (2), (3)	25·7	± 1·50
60 – 80	(1), (2), (4), (5), (6), (7), (8)	25·9	±0·79
80 – 90	(1), (6), (7), (9)	25·7	± 2·15
95 – 120	(2), (8), (10)	26·8	± 2·07
120 – 130	(2), (8)	25·1	± 5·4
Arithmetic mean		25·92	± 0·74

Since sucrose hydrolysis is also a first-order reaction in respect of water, the effect of sucrose concentration on the rate of reaction may be calculated. The changes in water concentration during the reaction are usually

[1] HIRSCHMÜLLER: Principles of Sugar Technology, Vol. I. Ed. HONIG. (Elsevier, Amsterdam.) 1953. pp. 1–17.
[2] BODAMER and KUNIN: *Ind. Eng. Chem.*, 1951, **43**, 1082.
[3] PINDAT: *Sucr. Franc.*, 1957, **98**, 176.
[4] HONIG: Principles of Sugar Technology, Vol. II. (Elsevier, Amsterdam.) 1963. pp. 188–223.
[5] STADLER: *Arch. Suikerind, Nederl. Ind.*, 1931, **39.III**, 689.
[6] ZHIDKOV *et al.*: *Trudy TsINS*, 1956, **4**, 180.
[7] JACKSON and GILLIS: *Zeitsch. Ver. Deutsch. Zuckerind.*, 1920, **70**, 521.
[8] WOOTTON: *Proc. 10th Meeting C.I.T.S.*, 1957, 66–81.
[9] FODOR and HAJÓS: *MTA Kem Tud. Oszt. Kozl*, 1955, **5**, 545.
[10] VERHAART and DE VISSER: *Proc. 10th Meeting C.I.T.S.*, 1957, 446–452.

negligible, so that, for practical purposes, sucrose concentrations may be considered as being at constant water concentration. Accordingly,

$$k_a = \frac{dx}{dt} \cdot \frac{1}{c} = k_o W \quad \ldots\ldots(1)$$

where k_a = reaction rate constant at a given concentration (min^{-1}), k_o = reaction rate constant at infinite dilution (min^{-1} ml g^{-1}), c = sucrose concentration (g/ml), and W = water concentration (g/ml).

In pure solutions $W = d - c$, where d = density (g/ml), hence

$$k_a = k_o (d - c) \quad \ldots\ldots(2)$$

The validity of Equation (2) has been verified by the author's earlier experiments[11] and by the recent accurate measurements by DEVILLERS and LOILIER[12].

From the above, a logarithmic formula suitable for the numerical calculation of the reaction rate constants in different conditions may be derived:

$$\log k_a = k_u + \log (d - c) - \frac{5670}{T} - \mathrm{pH} \quad \ldots\ldots(3)$$

where k_u is a general constant to be determined from experimental data.

The k_u values calculated from the available experimental data in various pH ranges are shown in Table II.

Table II

pH range	*Number of measurements*	k_u	*Significant difference*
≤ 1·00	16	17·05 ± 0·014	± 0·044
1·01 – 2·00	13	16·90 ± 0·016	± 0·13
2·01 – 4·00	9	16·85 ± 0·060	± 0·17
4·01 – 6·50	11	16·98 ± 0·050	

The figures in Table II have been calculated, in part, from data showing actually determined pH values[3,5,6,8,12,13], in part from other available data [2,4,7,9] suitable for the calculation of pH values according to DEVILLERS' results[14].

From Table II it is evident that k_u is constant in the pH range from 1 to 6·5 and has the probable value of 16·91 ± 0·026 min^{-1}.

Consequently, the rate of hydrolysis in the range of sugar concentrations from 0 to 0·9 g/ml, of temperatures from 20 to 130°C and of pH values from 1 to 6·5 may be calculated according to the formula

$$\log k_a = 16{\cdot}91 + \log (d - c) - \frac{5670}{T} - \mathrm{pH} \quad \ldots\ldots(4)$$

The definitive exponential form of Equation (4) is

$$k_a = 10^{\left(16{\cdot}91 - \frac{5671}{T}\right)} \cdot W \cdot a_{\mathrm{H}} \quad \ldots\ldots(5)$$

a_{H} representing hydrogen-ion activity.

Original determinations and literature data have shown[4,6,8,10,11,15] that the validity of this formula may be extended to the alkaline range not exceeding 0·4 pH units above the neutral point at given temperatures. In more alkaline media, however, the reaction rate constant shows an increasingly marked deviation from linearity. In beet sugar factory juices, this deviation is larger than in buffer solutions containing sucrose.

Sucrose hydrolysis in alkaline media

In alkaline media, hydrolysis of sucrose is rather a slow process while the hydrolysis products rapidly degrade to acids and browning substances. Research has only recently shown[16,17] that what happens in alkaline media is not an immediate decomposition of sucrose but here also hydrolysis is the primary reaction. The rate of the reaction may be determined: (i) by measuring the remaining quantity of sucrose[18] or (ii) by calculating with the help of empirical factors the quantity of hydrolysed sucrose from the resulting acids and reducing power[8,10,19,20].

The resulting reducing substances and total anion content have been determined by the author according to the methods of OFNER and WALLENSTEIN[21], respectively. An amount of 1 meq of total anion corresponds to 120 mg [in the vicinity of p(OH)1] to 140 mg [in the vicinity of p(OH) 4] of sucrose transformed into acid. The sum of the sucrose transformed into acid and of the reducing substances is approximately equal to the quantity of hydrolysed sucrose.

According to our determinations in buffer solutions of different p(OH) values at 90, 100 and 115°C as well as by calculating from some data available in the literature[10,18,19,20], the dependence of the reaction rate constant k_b(min^{-1}) on p(OH) in the temperature range from 90 to 120°C may be expressed by the relationship

$$\frac{\Delta \log k_b}{\Delta \mathrm{p(OH)}} = 0{\cdot}297 \pm 0{\cdot}023 \quad \ldots\ldots(6)$$

Data measured at 130°C[8] present considerably lower values. Consequently, at temperatures not exceeding 120°C, the reaction rate constant of hydrolysis is proportional to the 0·30 decadic exponent of hydroxyl-ion activity.

The reaction rate constants measured at various temperatures and reduced to identical p(OH) value have been used to calculate the activation energy of the reaction. Owing to experimental difficulties, the values obtained show considerable deviations; the arithmetic mean of the activation energies in the temperature range from 90 to 120°C is 24·4 ± 1·7 kcal/mole, from which the decadic exponent of the displacement with temperature will be $\frac{5340}{T}$.

[11] VUKOV: *Cukorip. Kutatoint. Evk.*, 1950, **1**, 215.
[12] *Ind. Alim. Agric.*, 1958, **75**, 465.
[13] SPENGLER *et al.*: *Zeitsch. Wirtsch. Zuckerind.*, 1938, **88**, 295.
[14] *Ind. Alim. Agric.*, 1958, **75**, 393.
[15] LITVAK and REVA: *Trudy KTIPP*, 1961, **24**, 8.
[16] CARRUTHERS *et al.*: *Paper presented to the 7th Tech. Conf., British Sugar Corp.*, 1954; *I.S.J.*, 1954, **56**, 218.
[17] WEIDENHAGEN: *Proc. 10th Meeting C.I.T.S.*, 1957, 43–54.
[18] ATHENSTEDT: *Zeitsch. Zuckerind.*, 1961, **86**, 605, 661.
[19] SPENGLER and TÖDT: *Zeitsch. Wirtsch. Zuckerind.*, 1941, **91**, 19.
[20] *idem ibid.*, 357.
[21] *Zeitsch. Zuckerind.*, 1957, **82**, 157.

In order to compare the effect of water concentration in alkaline media with that in acid media, the trials conducted in this Institute and the calculations from literature data[18,20] have unequivocally shown that, in alkaline media also, the reaction rate constant is proportional to water concentration provided the p(OH) is identical. The arithmetic mean of the differences in log k_b values, calculated from 7 pairs of measurement, is $\pm$ 0·00, the error being $\pm$ 0·025. Accordingly, in alkaline as in acid media, sucrose has first to undergo hydrolysis before degradation starts. This confirms the conclusions of CARRUTHERS *et al.*[16] and WEIDENHAGEN[17].

The reaction rate of sucrose hydrolysis, catalysed by hydroxyl ions, may be expressed by the following logarithmic formula:

$$\log k_b = k'_u + \log (d - c) - \frac{5340}{T} - 0{\cdot}30\ \mathrm{p(OH)} \quad (7)$$

Some 20 experimental determinations and further calculations from literature data[10,16,18,19] have resulted in the statistical relationship $k'_u = 10{\cdot}39 \pm 0{\cdot}030$. This is valid in the p(OH) range of 1 to 4·5 and the temperature range of approx. 90 to 120°C. The formula suitable for calculation is:

$$\log k_b = 10{\cdot}39 + \log (d - c) - \frac{5340}{T} - 0{\cdot}30\ \mathrm{p(OH)} \quad \ldots\ldots(8)$$

The definitive exponential form of Equation (8) is:

$$k_b = 10^{\left(10{\cdot}39 - \frac{5340}{T}\right)} \cdot W \cdot a_{OH}^{0{\cdot}30} \quad \ldots\ldots\ldots\ldots(9)$$

where a_{OH} represents hydroxyl ion activity.

If an additivity of the catalytic effects of hydrogen and hydroxyl ions is assumed, the pH value corresponding to the minimum reaction rate may be calculated from Equations (5) and (9):

$$\mathrm{pH}_{min} = \frac{1}{1{\cdot}3}\left(16{\cdot}91 - \frac{5670}{T} - 10{\cdot}39 + \frac{5340}{T} + 0{\cdot}3\ pW - \log 0{\cdot}3\right)$$

$$= 5{\cdot}42 + 0{\cdot}231\ pW - \frac{254}{T} \quad \ldots.(10)$$

pW = pH + p(OH), i.e. the negative decadic exponent of the ionic product of water at a given temperature.

The pH value corresponding to the minimum obtained in this way depends on temperature to a very small extent only: at 90°C it is 7·57, at 120°C, 7·53.

The experimental data agree well with the calculated values. According to WOOTTON's accurate measurements[8] carried out at 100, 110, 120 and 130°C the minimum reaction rate is found between pH 7·5 and 7·6. A calculation of the rates from WOOTTON's data will show rates in the vicinity of the minimum to be larger than the sum of the rates to be expected from the catalytic effects of both hydrogen and hydroxyl ions. The difference, an additive component independent of pH (in the ranges 6 to 8), is obviously caused by the salt used as a buffer. This effect has itself been demonstrated in a separate experiment by WOOTTON[8].

These facts prove the additivity of the reaction rate constants, i.e. the mutual independence of the catalytic effects, and, at the same time, emphasize the importance of the catalytic effect of the salts.

Sucrose hydrolysis catalysed by salts

The catalytic effect of the salts may be calculated from the difference of the reaction rates measured in buffer solutions of various salt concentrations and reduced to identical pH [p(OH)] value. The difficulty of accurately measuring the rates will cause comparatively considerable experimental errors: the quantitative relationships shown here will have to be regarded as approximations, permitting, however, some conclusions to be drawn in respect of sugar factory practice.

Experiments carried out with KCl in this Institute have shown the logarithm of the reaction rate constant catalysed by salts (k_s min^{-1}) to increase in a linear way with the logarithm of salt concentration, the slope of the straight line being approximately unity. WOOTTON's measurements with phosphate buffer give a similar relationship (except in excessive dilutions) with a slope of about 0·75.

Experiments conducted with a number of different salts show large differences as to their catalytic effects, the decreasing order of catalytic activities being disodium phosphate > calcium lactate > potassium chloride > sodium glutamate.

The catalytic effect of salts in the pH range 6–8 is independent of pH but increases considerably in strongly basic media, e.g. the catalytic effect of 0·5 molar KCl amounts to $k_s = 0{\cdot}5 \times 10^{-5}$ at pH 6·1, and $3{\cdot}3 \times 10^{-5}$ at pH 10·8.

The activation energy, calculated from the results of our experiments with KCl at 90, 99 and 107°C is 24·0 $\pm$ 3·1 kcal/mole. Consequently, the decadic exponent of the displacement of the reaction rate constant with temperature is $\frac{5250}{T}$.

The catalytic effect of salts in beet sugar juices

Since the qualitative and quantitative salt composition of beet sugar juices is extremely variable, information for practical purposes may be obtained by correlating the sum of the principal analytically determinable salt groups (S gram-eq/litre) with k_s.

$$S = A_s + N_a + A_g + C_a \quad \ldots\ldots\ldots\ldots\ldots\ldots(11)$$

where A_s = total anion (gram-eq/litre), N_a = amino-nitrogen (gram-eq/litre), A_g = total anion formed by invert destruction (gram eq/litre) and C_a = sum of cations equivalent to titration alkalinity in 1st carbonatation juices (gram-eq./litre).

As betaine has not been considered in this connexion, a certain further dispersion seems probable.

The value of k_s is obtained from the total hydrolysis rate constant (k_1, min^{-1}) determined experimentally and the calculated values of k_a and k_b:

$$k_s = k_1 - (k_a + k_b) \quad \ldots\ldots\ldots\ldots\ldots\ldots (12)$$

The linear connexion to be expected has been examined in 5 batches of 1st and 10 batches of 2nd carbonatation juice samples collected from several Hungarian sugar factories at different dates during the 1961/62 campaign.

A rather close correlation with the factor $r = 0{\cdot}82$ has been found. The regression equation is:

$$\log k_s = 1{\cdot}09 \log S - 3{\cdot}29 \quad \ldots\ldots\ldots\ldots\ldots\ldots (13)$$

For practical purposes, the coefficient 1·09 will be considered as 1. Introducing now the expression for the displacement of the reaction rate constant with temperature found above, an approximate formula suitable for numerical calculation will be obtained:

$$\log k_s = \log S + 11{\cdot}06 - \frac{5250}{T} \quad \ldots\ldots\ldots\ldots (14)$$

The definitive exponential form of Equation (14) is:

$$k_s = 10^{\left(11{\cdot}06 - \frac{5250}{T}\right)} \cdot a_s \quad \ldots\ldots\ldots\ldots\ldots\ldots (15)$$

a_s standing for the catalytic activity of salts (g. eq./litre) which under the above conditions numerically equals S.

This equation may be used as a good approximation in the temperature range of about 80 to 120°C in respect of 1st and 2nd carbonatation juices of 10 to 20°Bx of Hungarian origin or of similar composition.

In juice evaporation, the catalytic effect of salts will not increase in direct proportion to their equivalent concentration because their activity coefficients change. As a first approximation, the catalytic activity of salts may be regarded as being parallel to electrical conductivity except that reaction rates are also influenced by the decreasing concentration of water. Accordingly, maximum reaction rates will be expected in juices evaporated to about 25°Bx; at 55°Bx, the rate will drop to about 50% of the rate measured in thin juice. The corresponding experimental values were 86% at 35°Bx and 67% at 55°Bx, related to 14°Bx as a basis. The significant difference was ± 28%.

The catalytic activity to be expected during evaporation will therefore roughly correspond to the sum of the salt groups in thin juice, without causing a significant error. In the course of pan boiling and crystallization of thick juice, the catalytic activity of salts is smaller and will have to be determined by separate experiments.

The values calcula'ed according to the above relationships show, on the whole, a satisfactory agreement with our factory measurements and with BREVEGLIERI's data[22]. None shows a devia ion exceeding about 50%, the great majority being less than about 25%.

Conclusions

In aqueous solutions, the rate of sucrose hydrolysis catalysed by electrolytes may be calculated as the sum of the rates of reaction catalysed by hydrogen ions, by hydroxyl ions and by salts, respectively. The corresponding reaction rate constants appear in Equations (5), (9) and (15). These formulae are valid in the temperature range up to 120°C, in the pH range above 1, in the pOH range above 1, and in concentrations not exceeding 55°Bx.

Acknowledgment

This work was performed at the Research Institute of the Hungarian Sugar Industry, Budapest (Director: A. ZSIGMOND). Certain data were kindly made available by Mrs. K. MAGYAR. Thanks are due to Mrs. L. BÁRÁNY and Mr. J. ZANA for statistical calculations, to Misses M. NOVACSEK and L. BIHARI for technical assistance and to Dr. A. FALVAI whose counsel in preparing this paper is gratefully acknowledged.

[22] *Proc. 10th Meeting C.I.T.S.*, 1957, 143–155.

INTERNATIONAL SOCIETY OF SUGAR CANE TECHNOLOGISTS 12th CONGRESS

OVER 500 delegates attended the 12th Congress of the International Society of Sugar Cane Technologists which was held in San Juan, Puerto Rico, from the 29th March to the 9th April. They gathered from all over the world, registering at the Puerto Rico Sheraton Hotel where the Congress Headquarters was located.

The proceedings opened when the General Chairman, M. EMILE HUGOT of Réunion, introduced the General Vice-Chairman who spoke of the late M. A. DEL VALLE who, until his death, was General Chairman of the Congress and the driving spirit behind the Puerto Rico organization. The tribute paid to DEL VALLE by the General Secretary-Treasurer of the Congress, Col. FERNANDO CHARDON of Puerto Rico, was acknowledged by his son, M. J. DEL VALLE.

M. HUGOT then introduced the Hon. MIGUEL HERNÁNDEZ AGOSTO, Secretary of Agriculture for the Commonwealth of Puerto Rico, who welcomed the Congress to Puerto Rico and spoke of the increasing industrialization and proportionate decreasing of agriculture on the island. Sugar nevertheless occupies 48% of the cultivated agricultural land and provides 21% of employment in Puerto Rico. The industry is the biggest user of fertilizer, herbicides, etc.

The General Chairman then spoke of the influence of the I.S.S.C.T. on sugar factory development, which became faster and more regular after the formation of the Society in 1924. Work was continuing on widely differing topics, and a new and important Committee had been formed on coordination of sugar research, which was to assess the scope of work needed and methods to be examined. The range of the Society's interests and activities would be broadened and its authority enhanced.

An account of the Puerto Rican sugar industry was then provided by DUDLEY SMITH, who explained that since cane was grown in the coastal plains and mountain valleys of the island, production could not be increased by extension of the area and had to come from increased yields per acre. Raw sugar produced at the 24 factories is shipped from four bulk installations except that refined at three plants for local consumption. Of the growers, 31% produced cane on less than 100 acres while 60% grew cane on less than 200 acres. The same factories crushing 96,000 tons of cane per day had a capacity of only 44,000 tons thirty years ago. In the interval, eighteen factories having 6000 tons aggregate capacity had closed. Only two factories remained with a capacity less than 2000 tons of cane per day.

Fig. 1. The Puerto Rico Sheraton Hotel.

A resolution welcoming the Congress to the island which had been passed by the Puerto Rico Chamber of Commerce was then read by its representative, RAFAEL MORALES.

The Hon. HAROLD D. COOLEY, Chairman of the Committee on Agriculture of the U.S. House of Representatives, then addressed the delegates on U.S. sugar legislation, mentioning the recent progress in reaching agreement on recommendations for a new U.S. Sugar Act, and describing the purposes of the Act.

Purposes of the Committee on coordination of research in the cane sugar industry, referred to above, were then specified by the Chairman, R. R. FOLLETT-SMITH of England, as: (i) avoidance of waste in resources and personnel and (ii) avoidance of wasted work under conditions which are non-uniform and so prevent comparison. It has been found desirable to cover applied as well as basic research, and a three-layer body was formed, involving a policy-making panel, a group of directors of research, and panels for individual problems. A new section on basic research is proposed for the Congress.

Dr. L. D. BAVER of Hawaii described the analysis of 42 responses from questionnaires sent by the committee to research establishments which were designed to determine gaps in current programmes. These included faults in communication, effect of nematodes on cane, irrigation requirements, photosynthesis, yield decline, etc. The nature of ratoon stunting disease, cane growth, and sugar quality were chosen as three model problems for investigation. P. O. WIEHE of Mauritius, D. EVANS of British Guiana and C. W. DAVIS of Australia summarized present knowledge of these problems and indicated the fields in which investigation should be made.

On the morning of the 30th the various Sections of the Society met separately for reading of their appropriate papers, and these meetings continued throughout the day. On the following day, factory delegates were taken by bus to Central Fajardo on the east coast of the island, where they were able to inspect the factory which is owned by C. Brewer (Puerto Rico) Inc., asking for any in-

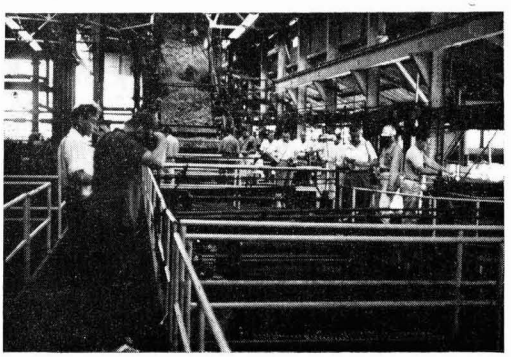


Fig. 2. Factory delegates in the mill house of Central Fajardo

formation they required from mill personnel who acted as guides. After lunching at a new hotel nearby, El Conquistador, the party continued south to Central Roig which they were also able to inspect thoroughly before returning to San Juan.

The field group were also taken by bus for a tour, their programme including a visit to the Brewer plantations at Humacao by way of Juncos where there was a short stop for a harvester display. After lunch the group were able to visit the Roig plantations at Yabucoa before returning to San Juan.

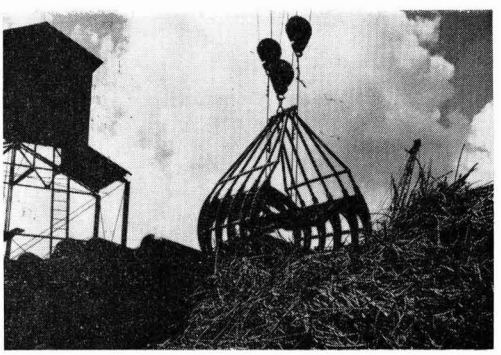


Fig. 3. Cane grapple at Central Roig.

On the following day the factory delegates continued with another day of meetings, the morning being devoted to a symposium of papers concerned with extraction of sugar from cane by diffusion techniques, a symposium which led to much discussion and questioning of the authors.

The field group schedule, meanwhile, included a visit to the Rio Pedras Experiment Station of the University of Puerto Rico and also the Gurabo sub-station, from which the party returned in the evening.

On Friday the 2nd April, the factory group visited Central Cambalache and examined the factory. Bagasse from the mill is carried by covered conveyor belt to the stockpile of the adjacent paper plant of Puerto Rico International Paper Corporation Inc., and delegates were able to visit the latter plant where the bagasse is converted into brown wrapping paper.

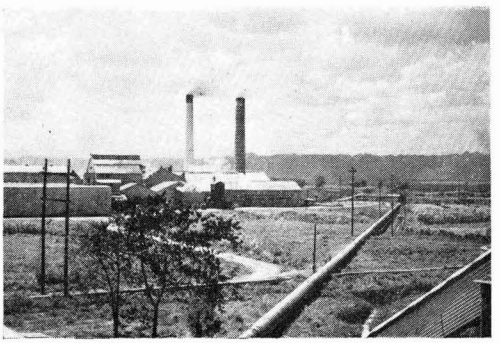


Fig. 4. Central Cambalache, showing the covered conveyor for bagasse

They then were taken to visit Central Los Caños, a growers' cooperative sugar mill, which they studied before returning to San Juan.

The field group held sectional meetings to read and discuss their papers, and similar sectional meetings were continued by both groups on the 3rd April. After the break on Sunday, the delegates went on two-day tours, travelling in opposite directions. The field group spent the day travelling to and examining field operations at Aguirre, stopping overnight in Ponce before continuing the next day to Mayagüez, where they were able to inspect the Igualdad plantations, and to Coloso, where a J. & L. cane harvester was demonstrated. The party then returned to the Puerto Rico Sheraton Hotel.

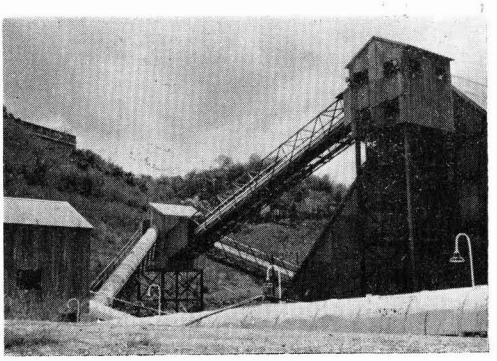


Fig. 5. Weigh house and conveyor housing at the Aguadilla bulk terminal.

The factory group went on the Monday morning to the Aguadilla bulk sugar terminal where they saw sugar received and put into store, also inspecting the facilities for weighing out the sugar and loading into the holds of vessels anchored in deep water off shore. Molasses tanks and a pipeline are also provided for loading of molasses tankers at the same installation.

The group continued to Central Igualdad where they were able to see the mill and refinery and also a small experimental unit for making bagasse boards which can be provided with veneer finishes and used for furniture, etc. After stopping overnight in Mayagüez, the party set off for Central Guánica which they were able to examine closely, and then Central Mercedita where delegates visited the factory, refinery and also the Serralles distillery where Don Q rum is produced.

ATTENDANCE AT THE CONGRESS

Antigua	2	delegates
Argentina	15	,,
Australia	27	,,
Barbados	6	,,
Bolivia	4	,,
British Guiana	7	,,
British Honduras	4	,,
Canada	1	,,
Colombia	5	,,
Costa Rica	3	,,
Czechoslovakia	1	,,
Denmark	1	,,
Dominican Republic	14	,,
Ecuador	1	,,
Egypt	2	,,
Fiji	1	,,
France	4	,,
French West Indies	30	,,
Germany	2	,,
Guatemala	2	,,
Hawaii	36	,,
Holland	3	,,
India	3	,,
Indonesia	2	,,
Iran	3	,,
Jamaica	22	,,
Japan	3	,,
Malgache Republic	1	,,
Mauritius	14	,,
Mexico	18	,,
Mozambique	2	,,
Nicaragua	4	,,
Panama	1	,,
Peru	13	,,
Philippines	5	,,
Réunion	10	,,
Rhodesia	1	,,
St. Kitts	9	,,
South Africa	33	,,
Spain	1	,,
Sweden	1	,,
Taiwan	3	,,
Trinidad	6	,,
Uganda	4	,,
United Kingdom	17	,,
United States	140	,,
Venezuela	28	,,
Zambia	1	,,
TOTAL	516	

Sectional meetings then took up the following day and part of the next, the closing plenary meeting taking place on the 9th April. Col. CHARDON reported on the resolutions which had been passed at the 11th Congress in Mauritius and the steps which had been taken to implement them. Chairmen of the various committees and sub-committees (which had been meeting during the Congress in addition to the sectional meetings) then presented their reports: Dr. I. E. STOKES of the U.S.A., Chairman of the Standing Committee on Germ Plasm, reported on the situation of the collections at Canal Point and Coimbatore as at the 1st January 1965 and on the publication of a newsletter. Dr. R. ANTOINE of Mauritius presented his report as Chairman of the Standing Committee on Sugar Cane Diseases; both volumes I and II of the authoritative "Sugar Cane Diseases of the World" have now been published, and a permanent collection of colour slides illustrating the diseases has been assembled.

J. R. WILLIAMS of Mauritius, Chairman of the Standing Committee on Sugar Cane Insects, reported that a book is in preparation which will provide a comprehensive list of insects. The report of J. L. CLAYTON of Australia, Chairman of the Standing Committee on Uniformity in Reporting Factory Data, is to appear in the Congress Proceedings; items requiring prompt review had been discussed and a panel of interested workers had been set up for examination of these.

Dr. BAVER, Chairman of the Standing Committee on Resolutions, proposed a standing vote of appreciation to the Governor of Puerto Rico and the Mayoress of San Juan, as well as to all the organizing committee and those concerned in Puerto Rico for the success of the Congress, to M. HUGOT, and to all officers of the Society. Delegates showed their eagerness to do so in full measure.

The Society had received invitations to hold the 13th Congress in a number of countries, and regional chairmen had asked the opinions of their members, who had accepted that of Taiwan. Mr. M. H. YUEN was then proposed as the next General Chairman, C. R. FLORCRUZ as the next General Vice-Chairman, and Dr. H. S. WU as the next General Secretary-Treasurer.

During the period of the Congress delegates had been entertained to a number of cocktail parties by organizations and Companies connected with the sugar industry in Puerto Rico, including a reception at the Town Hall in old San Juan, and the final event of this series was the farewell banquet after the closing session of the Congress, when a number of delegates from various parts of the world made short valedictory speeches.

The following day saw most of the delegates depart, but about 110 stayed and flew during the week-end to Florida, where a post-Congress tour of the sugar

area had been organized by DUDLEY SMITH. The factory delegates were able to visit Glades Sugar House of the Sugar Cane Growers Cooperative of Florida (the only mill still operating in Florida at that time) and Clewiston Sugar Mill of the U.S. Sugar Corporation. In addition they were able to visit the Everglades Experiment Station and the Research Station of the U.S. Sugar Corporation. The field

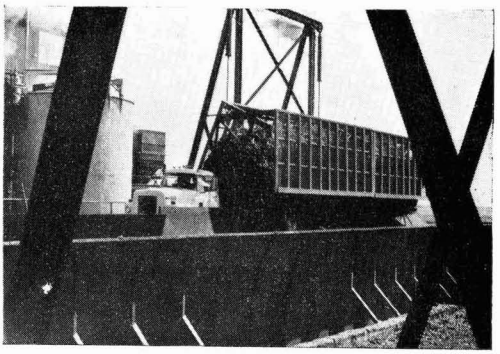


Fig. 6. Cane truck unloading at the Glades Sugar House

group were able to visit the Canal Point Breeding Station and see field operations near Belle Glade, as well as to see the Experiment Station, the plantation equipment making and repair shops of the U.S. Sugar Corporation and its cattle breeding and molasses feed operations.

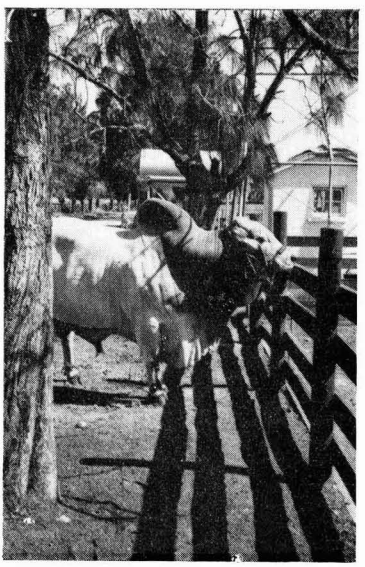


Fig. 7. One of the U.S. Sugar Corporation's champion Brahman bulls

All concerned in the organization and smooth running of both the Congress and post-Congress tour deserve the congratulation of all participating delegates who will, no doubt, be looking forward to the next Congress in 1968.

Correspondence

To the Editor, *The International Sugar Journal.*

Dear Sir,

RELATIVE DECOLORIZING POWER OF CAL CARBON AND BONE CHAR

Mr. CHAPMAN says[1] that like must be compared with like, but this is very difficult. We emphasized in our paper[2] that with the plant at York we were mainly interested in floc and foaming properties and not with the question of colour removal. However, the only information available to us on the use of carbon was based on this colour requirement and came mostly from cane factories in America. The data presented in the paper was by way of an introduction to explain our choice of material and plant. We are sorry that Mr. CHAPMAN thinks these data misleading.

For a seasonal beet sugar industry the capital cost of plant is of vital importance. We showed in our paper that for the York plant the operating costs were about 3½d per cwt on sugar produced whereas the depreciation on the capital cost of the plant alone came to about 2½d per cwt of sugar produced.

We feel that the decolorizing power is a function of the activity of the carbon, the contact time, and the flow rates of liquor and carbon, and these are, in practice, interdependent. So far as we were concerned the problem was how small a plant (which, incidentally, includes the furnace) could we build in order to minimize our capital costs and yet do a reasonable job.

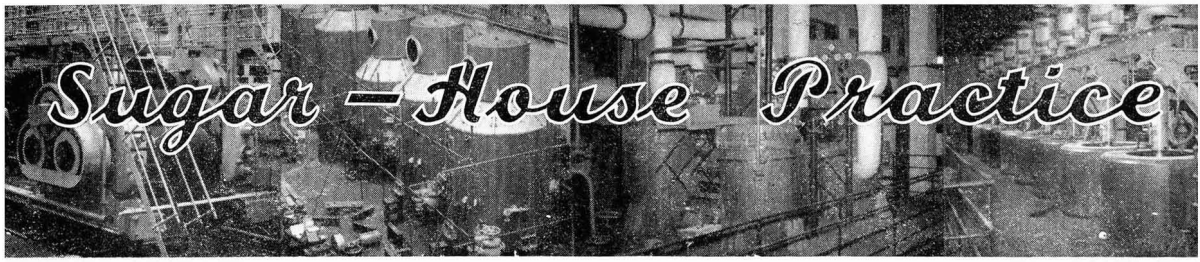
Mr. CHAPMAN's bone char regeneration plant would be significantly larger and more expensive than the one required for the CAL in his comparative example, and it is our opinion that the size of the absorption plant itself needs to be larger with bone char.

Yours faithfully,

R. M. J. WITHERS,

Chief Electrical Engineer,
British Sugar Corporation Ltd.

[1] *I.S.J.*, 1965, **67**, 142.
[2] *I.S.J.*, 1965, **67**, 80–81.



Examination of metal wear in milk-of-lime. N. A. SOLOGUB. *Sakhar. Prom.*, 1964, **38**, 835–837.—Results of tests in which various metals and grades of metals in friction pairs were subjected to wear tests with a 22% solution of pure calcium hydroxide are discussed. The hardest wearing pair was spherulitic iron with thin-sheet graphite, whereas non-ferrous metals in pairs with steel were subject to seizing and extreme wear.

* * *

Regulator for the level of (mud) suspension in the trough of a vacuum filter. S. N. PODOL'SKII. *Sakhar. Prom.*, 1964, **38**, 837–838.—A description is given of an automatic device for controlling the feed of mud to vacuum filters. The sensing device is a float connected by levers to an electrical circuit which feeds current to a solenoid valve, the main operating mechanism.

* * *

A new heat calculation method for a direct-flow evaporator station. G. A. KIMENOV. *Sakhar. Prom.*, 1964, **38**, 842–849.—Thirty-nine complex equations are derived for calculating a heat balance for an evaporator. The system, which defines and numerically evaluates individual components in evaporation, takes account of evaporation and flashing of a solution, heat losses to the surrounding medium by heat exchange, and vapour losses resulting from the incondensable gases and condensate flashing. The method omits all tolerances and is thus claimed to be more accurate than other systems.

* * *

The mathematics of sucrose extraction. A. L. WEBRE. *Sugar y Azúcar*, 1964, **59**, (10), 24–26.—The equation $E = 1{\cdot}00 - \frac{(S/F)_b}{(S/F)_c}$, where E = sucrose extraction, $(S/F)_b$ = sucrose % fibre in bagasse and $(S/F)_c$ = sucrose % fibre in cane, is discussed and applied to extraction results at Glades Sugar House, Florida, where, following a freeze, the worst damaged cane was harvested first and progressively less damaged cane harvested subsequently so that the cane quality and $(S/F)_c$ became progressively higher. The data are expressed in a number of graphs which show that the milling losses varied only slightly during the period and that crushing rate is the factor that most affects milling loss, imbibition rate being a less important factor.

* * *

Automatic control improves clarification. B. A. OXNARD. *Sugar y Azúcar*, 1964, **59**, (10), 27–28. The new automatic phosphate defecation station at the Philadelphia refinery of National Sugar Refining Co. is described and illustrated. Washed sugar liquor of 62–64°Bx, at a controlled temperature of 160°F, passes through four 80-mesh vibrating screens to a holding tank and phosphoric acid added by a ratio controller governed by liquor and acid flowmeters. Addition takes place at the first stage of an in-line mixer, lime sucrate being added at a second stage under the control of a pH meter located immediately after the mixer and regulating to pH 7·2–7·4. The liquor passes to a second holding tank and thence to five primary "SuCrest" flotation clarifiers to which heat is supplied through steam coils and air pumped into the liquor at the clarifier inlet. Flow through each 5000-gal clarifier is regulated at 100 g.p.m. and the outgoing liquor temperature controlled at 190°F by an automatic steam valve. The scum is diluted to 15–20°Bx and treated in a secondary clarifier of similar design with aeration and heating to 200°F. The pH is 7–8 and the clear sweet-water produced at the rate of 20–50 g.p.m. is used to melt the washed raw sugar. The secondary scum is diluted to 8–10°Bx and treated in a Titan continuous centrifuge to give a sweet-water for melting and a mud which is again diluted, to 1°Bx, and re-centrifuged. During its first six months of operation the station has improved colour removal from 35 to about 50% and ash removal by 5–10%, so that char loading has been reduced and the burn rate reduced by 40%. Char effluent colour is 55% lower and sugar colour 35% lower. Less water is needed in the centrifugals and pan yield is 8% higher. A panel for the instruments has been designed and installed by Fischer & Porter Co.

* * *

How to rate continuous centrifugals. E. DELDEN. *Sugar y Azúcar*, 1964, **59**, (10), 31, 49.—In order to specify the capacity of continuous centrifugals it is suggested that a standard purity drop of 25 units from massecuite to molasses be introduced as the basis for throughput comparison. Since the relationship between crystal yield and purity drop is almost linear, the capacity can then be simply calculated for a different purity drop.

* * *

Costa Rica modernizes its sugar industry. C. A. RAMÍREZ. *Sugar y Azúcar*, 1964, **59**, (10), 32–33.—A brief illustrated account is given of recent developments in the sugar industry of Costa Rica. These include adoption of the Barbados cane variety B 37161, soil analysis for nutrient deficiency, chemical weed control, overhead irrigation and mechanical cane loaders. Use of cranes for cane delivery to the feed tables permits might crushing, while extra mills, knives and shredders, and new gearing have raised crushing rates. New furnaces have been installed

and water-tube boilers instead of the old fire-tube boilers. Juice heaters and continuous clarifiers are now used, and vegetable mucilage clarification has been replaced by sulphitation treatment. Triple- and quadruple-effect evaporators are used, and magma seeding and 2- and 3-boiling processes have been adopted. Modern semi-automatic and continuous centrifugals and water-cooled crystallizers are becoming more common, as is the use of vacuum pan instrumentation. Sugar production has thus been increased from 44,000 short tons in 1955/56 to 97,000 tons in 1962/63 and an estimated 120,000 tons in 1963/64.

* * *

Boiling of cube sugar massecuites and production of cube sugar seed. I. R. BRETSCHNEIDER. *Listy Cukr.*, 1964, **80**, 260–264.—The fundamentals of massecuite boiling for cube sugar production and the production and pressing of the resultant fine-grain sugar are discussed as are the factors affecting the quality of the end product (moisture of the slabs, accurate cutting and packaging). Chemical control and control based on quantitative factors are described.

* * *

The double-walled sugar silo. A. ROUSSEAU. *Sucr. Franç.*, 1964, **105**, 283–285.—A description is given of a silo design in which air is circulated in the space between the outer wall and an inner wall, the latter provided with slats of the Venetian blind type to allow moisture to escape from the sugar into the air stream. (Sugar would not pass through the inner wall since the slats would be so inclined that one immediately below would retain the natural slope of the sugar.) Conditioned air would also be circulated beneath the wooden floor of the silo. Sugar would be reclaimed through 45° inverted cones below the floor. A central perforated pipe for blowing air into the stored sugar is also envisaged.

* * *

Influence of (cane sugar) manufacture on the yield obtained. H. T. TAN. *Balai Penjelidikan Perusahaan*[2] *Gula. Warta Bulanan*, 1964, 27–38; through *S.I.A.*, 1964, **26**, Abs. 735.—The system of sugar yield calculation used in Java, based on primary (undiluted) juice % cane, Brix extraction, raw juice purity factor and "Winter rendement" is described. The equations are criticized on account of their being partly dependent on characteristics of the cane. The various equations for boiling house performance are compared with the Winter rendement which gives a high value more easily with raw juice of low purity. Sources of sugar loss in process are briefly discussed, and equations for judging molasses exhaustion are reviewed in detail with 9 references to the literature during 1931–1955.

* * *

Sugar cane processing polyelectrolytes in juice improve mud filtration. W. F. GUILBEAU, J. T. JACKSON, E. E. COLL and S. J. CANGEMI. *Sugar Bull.*, 1964, **43**, 38–40.—The effects of "Separan AP-30" and "Nalco D-1782" polyelectrolytes on clarifier mud filtration were studied, using a Dorr-Oliver leaf filter. Compared with the control, "Separan" gave 17% less mud, the juice content of which was reduced by 22%. It gave a 16% higher filtration rate and increased filter capacity by 33%. The corresponding values for "Nalco" were 19% less mud, 24% less juice, 22% higher filtration rate and 37% increased filter capacity.

* * *

The incidence of Brix-free water on milling performance. T. FOURMOND. *S. African Sugar J.*, 1964, **48**, 827, 829.—Brix-free water is defined as cane minus fibre minus undiluted juice. This quantity varies from day to day, examples showing a variation between 16·37% and 24·7% on fibre during a 7-week period at Amatikulu. The effect of such variations on assessment of milling results is discussed and exemplified. It is recommended that the figure be examined where unusual fluctuations in milling performance are encountered.

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Steam economy measures. B. L. MITTAL. *Indian Sugar*, 1964, **14**, 435–436.—Practical objections to the proposals of PHANSALKAR *et al.*[1] are presented, with new calculations of heating surface required for juice heaters based on a maximum juice velocity in the tubes of 6 ft/sec, and temperature drop of 3° and 6°F. For the lower figure a juice heater would have very large dimensions to obtain the required juice velocity, and the pump would have to provide a large head of pressure. Third stage heating (to 210–212°F) with 1st evaporator effect vapour (at 215°F) is not considered practical because the 3–5°F difference is insufficient to allow for variation in the 1st vapour temperature; in addition, the heating surface required is also unpractically large, unlike the case when exhaust steam is used. Further, it is calculated that the required vapour is not available except from the vapour cell. Use of vapour for boiling instead of exhaust steam would reduce pan efficiency and capacity, while boiling juice in the vapour cell at 222°F would increase sucrose inversion and caramelization. The costs of the PHANSALKAR proposals are not completely allowed for in the calculations.

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Washing table solves debris problem. J. H. ACEVEDO. *Sugar y Azúcar*, 1964, (11), 65–66.—Mechanically-harvested cane delivered to Central San Vicente, Puerto Rico, often is covered with mud, and a washer has been installed to prevent the mud entering the mill. The washer comprises two inclined tables fitted with conveyor chains which drag the cane from one table to the other and thence to conveyors feeding the mill. Levellers operate in two stages to give a cane blanket 10 inches thick, and 3000 g.p.m. of water is sprayed onto this. Mud is carried through the $\frac{3}{4} \times 1\frac{1}{2}$-inch perforations in the tables, which have an open area of 46%, and falls with the water into a channel feeding a pipe which discharges into

[1] *I.S.J.*, 1965, **67**, 115.

a river. The washer has a capacity of 5000 tons of cane per day and is fed by cranes of 4000 tons/day capacity; the latter is to be expanded to 5000 tons.

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The collection and use of condensates. A. L. WEBRE. *Sugar y Azúcar*, 1964, **59**, (11), 75–78.—Two important characteristics of condensates for use as boiler feed are their purity and temperature; steps to maintain the former are reviewed, including use of oil and entrainment separators, and avoidance of hydraulic hammer by care in valve closure. Other uses of condensates are listed, and techniques for storage and piping are described. A method for flash-cooling of condensates to be used as maceration water is described and illustrated.

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Bulk storage of raw sugar. F. N. DOBRONRAVOV and G. V. ACHKASOVA. *Sakhar. Prom.*, 1964, **38**, 901–903. Cane raw sugar was stored in bulk in a special enclosure in a warehouse on an asphalt floor and covered with a tarpaulin. After 270 days at R.H. values in the range 85–99%, the sucrose content had fallen from 97·8% to 96·2%, the invert sugar and ash contents had increased from 0·86% to 0·95% and from 0·28% to 0·38% respectively and the colour from 38·5°St to 53·0°St. Weight loss due to moisture loss and due to undetermined losses was 0·26% and 0·37% of the initial weight, respectively. No quantitative increase in the number of acid-forming bacteria was observed. After subsequent storage for 57 days in sacks, a further weight loss of 0·69% was observed, while the sucrose content had fallen by a further 0·41%. During the first two months of the test the safety factor exceeded what is considered by the author to be the upper limit of 0·33.

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Corrosion problems. H. KÖHLE. *Zucker*, 1964, **17**, 653–660.—The electro-chemical theory of corrosion is discussed and exemplified by causes of corrosion in aqueous and vapour phases. The rôle of oxygen in corrosion in hot systems is discussed as is the effect of mechanical stresses. Particular emphasis is laid on corrosion occurring during shut-downs, and means of preventing this are described. Two possible methods of "preserving" boiler equipment are given: (1) a dry method, in which all water is discharged and feed points sealed against atmospheric moisture, and (2) a wet method, in which the equipment is sealed against oxygen. In method (1) the boiler can be dried out by injecting air; if not all the water can be removed, the use of an ammonia atmosphere will minimize corrosion, but care must be taken when flushing out the ammonia with air that no flame comes into contact with the mixture which becomes explosive at a ratio of 80% air to 20% ammonia. In method (2) hydrazine is considered the best corrosion preventive, reacting with oxygen to form water and nitrogen (in high-pressure boilers, ammonia and nitrogen are formed).

Boiling of cube sugar massecuites and production of cube sugar seed. II. R. BRETSCHNEIDER and P. KADLEC. *Listy Cukr.*, 1964, **80**, 290–299.—The processes involved in production of cube sugar (boiling, crystallizing, curing, cutting and pressing) are analysed and detailed analyses presented of boiling (from 1st and 2nd clear liquors), cooling in a Werkspoor crystallizer, sieve analysis of the massecuite crystals, massecuite Brix, etc. Cooling in a mixer and then in a Werkspoor crystallizer is technologically justified while an increase in the solids yield is attributed to lack of strict control in the initial mixing of the syrup. The curing has been found to be satisfactory. Some variation in the output from the rotary presses is ascribed to lack of uniformity in the cutting, again due to lack of laboratory control of the whole process.

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Experiences in the use of "Separan AP-30" as flocculating agent. J. E. PABALE and B. J. HIBEK. *Proc. 11th Ann. Conv. Philippines Sugar Tech.*, 1963, 80–82. Following laboratory trials, use of "Separan AP-30" on plant scale was adopted at Canlubang for the 1962/63 crop. A 0·5% stock solution is made up and diluted to 0·025% before adding at the top of the clarifier flash tank at the rate of 0·75 lb of "Separan" per ton of insoluble solids (2–3 p.p.m. on cane weight). Addition starts after the week-end shut-down and continues until clear juice clarity is constant (usually 24–36 hr). Similar addition, usually for 24 hr, was made to vacuum filtrate before returning to the clarifier, 0·50 lb of "Separan" being used per ton of insoluble solids. During poor clarifier operation and when filter-cake was sticky or slimy it was limed to pH 8·2–8·4 and "Separan" was added (at 0·75 lb/ton of solids) at the clarifier and pump to ensure good mixing before the mud reached the vacuum filter. Good flocculation resulted from the use of "Separan" and harmful effects resulting from slimy mud were overcome. The high boiling house recovery of 92·85% is attributed in part to the flocculant.

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"A"-massecuite crystallizer cooling. E. A. GRAPA and A. C. ALBA. *Proc. 11th Ann. Conv. Philippines Sugar Tech.*, 1963, 83–85.—The use of Werkspoor "Rapid" water-cooled crystallizers for *A*-massecuite has been adopted at Central Bais in order to permit increase in milling rate from 3600 to 4200 tons of cane per day. False grain formation is prevented by regulating the (counter-current) water flow to give a temperature difference of 15–20°C between ingoing massecuite and outgoing water. After 45–60 min, the massecuite is cooled from 65–70°C to 52–54°C and is discharged. Boiling-back of *A* molasses has been reduced (from 24 to 10%), crystal content increased, and total massecuite volume reduced by 13% with a consequent increase in pan capacity and decrease in steam requirements.

BEET FACTORY NOTES

New filtration methods. M. Kříž. *Listy Cukr.*, 1964, **80,** 301–304.—Some details are given of tests with a new filter candle developed in Czechoslovakia for use in pressure filters treating carbonatation juice and refinery liquors. Filtration of clarified 1st carbonatation juice of 16°Bx, using "Hyflo-Super-Cel" as pre-coat, gave a sparkling, clear juice and reduced the CaO content from 0·24 mg/100 ml to 0·12 mg/100 ml.

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Drum drying of beet pulp. A. Schwieter and F. Baunack. *Zucker*, 1964, **17,** 576–579.—Investigations of the flow rate of beet pulp in drum dryers and of the shrinkage of the material during drying have shown that the level of pulp at the feed end is greater (by some 300%) than at the opposite end. Hence the efficiency can be raised by installing a unit rotating more rapidly at the feed end, e.g. two drums rotating at different speeds and placed one after the other. Other such modifications described in the literature are discussed. The adverse effect of the entry of secondary air into dryers (reducing the thermal efficiency and pulp quality) is also considered. Among the measures suggested to reduce fuel consumption are: (1) replacing a portion of the furnace combustion air with recycled vapour to reduce the amount of waste gas and increase the moisture content of the discharged vapour, and (2) feeding boiler flue gas.

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A contribution to boiler house control. W. von Proskowetz. *Zucker*, 1964, **17,** 579–584.—An attempt is made to express as simply as possible the important factors in the control of the boiler house, with the aim of helping readers who are not acquainted with heat engineering. Particular stress is laid on the direct and indirect determination of heating efficiency, and the various factors to be evaluated for this are discussed.

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Storage of white sugars in bulk. P. Devillers. *Ind. Alim. Agric.*, 1964, **81,** 611–619.—The techniques of sampling white sugar and measuring its E.R.H., moisture and reducing sugars contents and micro-organism count, are reviewed. The relationships between the E.R.H. and sugar moisture and purity are discussed and their inter-dependence illustrated by a graph. The phenomenon of "maturation" where the E.R.H. of sugar rises on storage after drying is described as are experiments on the relationship between microbiological activity in sugar and its E.R.H. The significance of these phenomena in regard to bulk storage is then considered and it is concluded that sugar straight from the dryer is not suitable for sealed storage because of moisture migration leading to fermentation and reducing sugars formation. It is found that passage of dry air through the sugar during filling of the silo will not find great resistance or take much power, but will avoid caking and local moistening of the sugar.

Molasses formation. P. M. Silin. *Ind. Alim. Agric.*, 1964, **81,** 737–740.—See *I.S.J.*, 1964, **66,** 255–258.

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The economical limits of sugar extraction from beet. S. Zagrodzki and S. Zagrodzki. *Zeitsch. Zuckerind.*, 1964, **89,** 568–572.—See *I.S.J.*, 1963, **65,** 21.

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Application of ion-exchange resins in the Japanese beet sugar industry. A. Miyahara. *Kagaku no Ryoiki* (J. Japanese Chem.), 1962, **16,** 627–632; through *S.I.A.*, 1964, **26,** Abs. 664.—A general review (with 21 references) is given of the technique of ion-exchange purification and of the various commercial processes. The two processes commonly used in Japan for thin juice purification (the Japanese Organo process and the conventional American process, i.e. strongly acidic cation-exchange resin followed by weakly basic anion-exchange resin) are discussed in more detail.

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Factory experiments on the use of calcium chloride as an aid to pulp pressing. J. Corish, N. Healy, M. Kiely, R. Molloy and R. Carolan. *Irish Sugar Co. Ltd. Research & Devel. Dept. Rpt.*, 1964, (67), 14 pp. Detailed results are presented of tests at the four Irish sugar factories where the pressed pulp moisture content was reduced by addition of calcium chloride to the diffuser feed water. The economics of the treatment are calculated and discussed, and it is concluded that the saving in fuel through better pulp pressing outweighs the cost of the treatment.

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Results of tests on a J-VIII diffuser. A. K. Buryma and N. Ya. Artemova. *Sakhar. Prom.*, 1964, **38,** 829–835.—A 1500-ton/day J-VIII tower diffuser at Sadovskii factory had the following performance data (average of 27 days): approximately 1225 tons of beet processed daily, 0·23% sugar lost in pulp at a draught of 133·5% and a pulp yield of 75% on weight of beet. The juice was of high quality with a pulp content of only 0·23 g/litre. Details are given of optimum cossette length and diffusion temperature.

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Increasing the throughput of oil-fired pulp drying units. V. V. Zvorykin and M. P. Khazin. *Sakhar. Prom.*, 1964, **38,** 850–856.—At Gindeshtskii sugar factory certain modifications were made to the oil-fired pulp drying unit; the alterations mainly concerned the fuel jets. Subsequent tests showed too low a throughput, attributed to over-drying of the pulp. At a final moisture content of 12% instead of 2% the throughput was raised from 69·6 to 77·6 metric tons/day and the specific fuel consumption reduced. The waste gas temperature rose from 120–130°C to 157°C. A guide is given to calculation of pulp dryer throughput with the aid of values for three different non-Soviet

dryers. A nomogram is also presented for throughput determinations for a drum of known length and diameter, together with a worked example.

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Silos for bulk storage of granulated sugar. K. P. PUTYAKOV. *Sakhar. Prom.*, 1964, **38,** 857–860. Information is given on the construction of silos at three Soviet sugar factories. Each factory has a unit of three silos made from reinforced concrete. The effective volume of each silo is 43,500 cu.m.

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Centenary of the diffusion process in the sugar industry. J. BARTOŠEK. *Czech. Heavy Ind.*, 1964, (11), 23–32. The first beet sugar factory was established in 1802 but juice was obtained in mills similar to those for cane. The diffusion process was used for the first time in the 1864/65 campaign at Židlochovice factory in Moravia, a factory still in operation. An account is given of the development of the Robert technique employed and its improvement, with illustrations of some of the machinery of the period including a continuous diffusion tower design by ROBERT which, however, did not find application. Notes made by a visiting technologist on the Bohemian and Moravian sugar industries in 1957/58 are summarized and quoted. Contributions of Czechoslovak technologists since this time are surveyed, and current processes and products are briefly reviewed.

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Universal application of the new pre-coat pressure filters type Škoda-FSKO. N. ŠKRÁBAL. *Czech. Heavy Ind.*, 1964, (11), 33–38.—The Škoda-FSKO filter is a candle filter employing perforated stainless pipes which are wound with a stainless steel wire on which kieselguhr may be deposited before filtration of carbonatation and thick juices, refinery syrups, etc. Full details of its construction and use are provided.

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Study tour of the Soviet Union. V. Mechanization of sugar beet (un)loading and storage. S. JERMY. *Cukoripar*, 1964, **17,** 279–284.—Beet storage and unloading-piling equipment and techniques in the U.S.S.R. are described and such factors as soil and climate, agrotechnical methods, beet agriculture organization, method and time of beet harvesting and beet reception are also discussed.

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Notes on problems concerning power engineering in the sugar industry. J. ENDRODI. *Cukoripar*, 1964, **17,** 287–289.—A study of factory data for the 1963/64 campaign at 11 Hungarian sugar factories revealed that in 7 there was a linear relationship between specific fuel consumption and thick juice Brix. In the other 4 factories no such relationship was found and a thorough investigation of the heat economy at these factories is recommended.

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Dimensioning control valves for carbonatation gas. M. BRUNKE. *Zucker*, 1964, **17,** 598–600.—Values of K_v (volume of gas flowing through valve opening) have been calculated from a basic equation (according to German Standard 1952) and tabulated. From these, graphs have been drawn of K_v *vs.* daily throughput (tons) for (1) schemes incorporating pre-carbonatation and (2) the Braunschweig carbonatation scheme. The nominal diameters of control valves may be calculated from the gas conditions required.

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Test of the work of a diffusion battery on beet cossettes obtained with electro-polished beet knives. V. N. OSTAPENKO and V. G. ZOZULYA. *Trudy Grupp. Lab.*, 1959, 35–42; through *S.I.A.*, 1964, **26,** Abs. 753.—The knives, after sharpening and cleaning in the normal way, were treated by electrolysis at 8–10 V, 75 A (D.C.) in a bath of 65% H_3PO_4, 15% H_2SO_4 and 6% CrO_3 for 4–7 min. The treated knives had a polished appearance and were compared with sharpened, untreated knives for the slicing of partly frost-damaged beets at a Ukraine factory in 1957. The cossettes obtained with the treated knives were thinner and contained fewer fragments than the controls, with a resulting increase of 10% in the diffuser capacity and a 5% decrease in sugar losses.

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Investigation of the electroplasmolysis of a beet cossette under pressure. A. YA. ZAGORUL'KO. *Trudy Grupp. Lab.*, 1959, 27–34; through *S.I.A.*, 1964, **26,** Abs. 754.—The influence of pressure on the specific resistance of beet was studied on a piece of either fresh or stored beet. The resistance dropped with increasing pressure (from 9400 to 8500 ohm-cm at 2·5–3 kg/sq.cm.). This is regarded as the point of full internal contact between the cells. The resistance remained constant at pressures up to 22–25 kg/sq.cm. above which the value decreased rapidly owing to disintegration of the tissue. With stored beet a tendency for resistance to decrease appeared at pressures >6 kg/sq.cm. before the final breakdown at 22 kg/sq.cm. The relative compression of fresh beet increased linearly with pressure up to a value of 0·20 at 12·5 kg/sq.cm., increasing more slowly at higher pressures. The points of full internal contact and tissue breakdown correspond to relative compressions of 0·03–0·06 and 0·28 respectively. The possibility of carrying out electroplasmolysis under moderate pressure in one or two stages is discussed.

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Diffusion juice purification effect with varying duration of carbonatation. A. K. GOPAK and A. P. PUSTOKHOD. *Trudy Grupp. Lab.*, 1959, 63–64; through *S.I.A.*, 1964, **26,** Abs. 757.—Diffusion juice with 2·5% lime addition was subjected to 1st carbonatation for 7–25 min, the gas flow rate decreasing with increasing duration. The purity of the thin juice decreased and its colour increased with increasing time of carbonatation.

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Return of brown sugar melt to the raw juice tanks. F. N. DOBRONRAVOV and A. M. GERASIMOVA. *Trudy Grup. Lab.*, 1959, 57–60; through *S.I.A.*, 1964, **26,** Abs. 758.—Brown 2nd product sugar from beets deteriorated in storage was melted with thin juice

and returned to the raw juice in order to improve the white sugar colour. The removal of colour in carbonatation was relatively slight, and the white sugar colour was worsened. A better result was obtained by affination of the brown sugar with 2nd green run-off syrup diluted to 70°Brix at 80°C, melting the affined sugar with thin juice and adding the melt to thick juice before sulphitation. The affination of 2nd sugar led to a reduction of 30% in the white sugar colour in comparison with the melt purification process.

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Data processing in settlement of beet accounts in the Danish sugar industry. E. WULF. *Zucker*, 1964, **17**, 617–619.—Details are given of the punched-card system used for beet and wet pulp accounts.

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Advances in measuring and control techniques for sugar process. V. RUSBÜLDT. *Zucker*, 1964, **17**, 619–624. A survey is presented of modern apparatus and techniques for measuring and controlling various factors in sugar production. These include continuous pH measurement with glass electrodes (with an amplifier as impedance transformer cut in because of the high resistance of the electrode circuit) and measurement of fluid density in a pipeline using radio-isotopes. Details are given of a fully-transistorized GEACONT controller used in conjunction with an AEG pH meter (with interchangeable plug-in units) used to regulate the dosing of press-water with HCl and, with an AEG throttle control, the addition of milk-of-lime to juice at pre-defecation. At the Ochsenfurt factory of Zuckerfabrik Franken G.m.b.H. press-water pH was maintained constant at $\pm$ 0·5 units while that of pre-limed juice was maintained to within $\pm$0·13 units. Thick juice Brix was maintained at $\pm$1·7° using a caesium-137 radiation device in conjunction with a GEACONT controller which regulated thin juice addition. Details are given of a radio-isotope device for continuous control of diffusion tower juice Brix, which is based on the separation of pulp from the juice. The juice flows through a fine mesh screen which is in the form of a cascade and which is oscillated by a continuously adjustable vibrator. Manual control by this means has shown promise and automatic control is considered feasible.

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Transportable beet tipping and piling units. G. WICENEC. *Zeitsch. Zuckerind.* 1964, **89**, 637–639. Details with illustrations are given of a new unit manufactured by Gebr. Bütfering of Beckum (Germany). This consists of a long tipping platform on each side of a rake conveyor which has a capacity of 360 tons of beet/hr. The beet are tipped onto this and conveyed to a dirt removal vibrator and thence to an adjustable conveyor, at right-angles to the main unit, which transfers the beet to the pile. The dirt from the beet falls through a hopper into trucks.

Beet tail untilization. K. H. SCHÖNBURG. *Zeitsch. Zuckerind.*, 1964, **89**, 639–640.—A classifier designed and tested at Wetterau sugar factory for the separation and classification of impurities from beet is described. It divides the solids into 3 groups: (1) leaves, weeds, straw, etc., (2) stones, iron, etc. and (3) beet tails and pieces. The solids fall into a vertical, cylindrical tank in which water rises at a set rate, carrying leaves, weeds, etc. to the top where they overflow onto a screen. The water drains through the screen into an annular tank surrounding the cylinder and is pumped into the bottom of the cylinder. The leaves are pumped to a press and are then added to the pressed pulp. The stones and beet tails fall to the bottom of the cylinder and enter a downward sloping pipe passing through the annular tank to a vertical stone elevator tower. Water fed to the bottom of this tower causes separation of the stones from the tails before they enter the tower; the tails are then carried up a branch tower and are added to the beet before the slicers. The stones are discharged from the top of the elevator tower.

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Filtration equipment in the sugar industry. R. OGLAZA. *Gaz. Cukr.*, 1964, **72**, 229–238.—Descriptions and illustrations are given of eight different types of candle filters designed for the sugar industry. They include the Kwant Sneck system (Dutch), the Olier AKA, Philippe TCS (for 1st and 2nd carbonatation juice) and TCSS (for thick juice and clear liquor), an East German model, the BMA, Stellar and Schumacher models, and the Niagara filter.

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New trends in protection and storage of sugar beet. A. KARATNICKI. *Gaz. Cukr.*, 1964, **72**, 242–244.—The factors affecting stored beet quality (including withering of the roots, soil adherence to the beet and root growth in piles) are discussed and results achieved by the Beet Sugar Section of the Sugar Industry Institute (Poland) in beet storage tests are reported. These results agree closely with others obtained outside Poland. Factors requiring further study are also discussed.

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Notes on the use of mechanical ventilation in sugar beet storage in the light of results of tests carried out in 1961–63. J. ANTKOWIAK. *Gaz. Cukr.*, 1964, **72**, 245–250.—Results of tests during 3 campaigns show an average daily sugar loss in stored beet of 0·071% with forced ventilation and 0·114% with natural ventilation. Forced ventilation with a 7 kW fan delivering 48 cu.m. of air per hr per ton of beet through a system of pipes cooled the beets much more rapidly than did natural ventilation using a series of vertical pipes protruding through the top of the pile. It took 15–25 days to attain 5°C with forced ventilation, compared with at least 34 days using natural ventilation.

Methods of determining the sedimentation and filtration properties of 1st carbonatation juices. S. GAWRYCH. *Gaz. Cukr.*, 1964, **72,** 213–217.—The methods used and the forms in which clarification and filtration efficiencies are expressed are discussed and descriptions with diagrams are given of a number of laboratory filters and micro-filters.

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Tests with a rapid method of determining the extent of infection in a DDS diffusion unit. I. JANUSZEWICZ. *Gaz. Cukr.*, 1964, **72,** 218–221.—Determination of bacterial counts and activity in water used for diffusion (sweet-water, press-water and circulation water) using 2,3,5-tetrazolium chloride (TTC) (1 ml of 0·1% aqueous solution in 9 ml of test solution) showed that the highest bacterial count occurred in circulation water, in which bacterial activity (as measured by fall in pH) was also greatest. The most rapid development of bacteria after 2 hours' incubation also occurred in circulation water. Reduction in bacterial development in the 4th compartment of the diffuser was attributed to a considerable change in the diffuser temperature compared with the temperature of the water. In compartments 2 and 3 the bacterial counts were still low, consisting only of micro-organisms resistant to high temperatures, but their development was prolonged. This phenomenon was reflected in the rapidity and intensity of coloration due to reduction of the TTC. Two hours after adding 0·0036% formalin (half to the press-water tank, half to the 4th compartment) the thermophile count in the diffusion water from all sources was considerable, while reduction of the TTC clearly indicated that the formalin was inhibiting their development. In compartment 1 coloration due to TTC reduction did not occur within 2 hr, probably because the thermophiles originated in the cossettes. Further tests with formalin showed that TTC was a better indicator of the degree of infection than was pH.

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The nitrite control of raw juices as a means of evaluating bacterial avtivity. L. COX and M. TVEIT. *Zucker*, 1964, **17,** 625–627.—See *I.S.J.*, 1965, **67,** 121.

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Ion exchange resin catalysis of sucrose inversion in fixed beds. E. W. REED and J. S. DRANOFF. *Ind. Eng. Chem. Fundamentals*, 1964, **3,** 304–307.—The kinetics of continuous sucrose inversion catalysed by fixed beds of cation exchange resin in H^+ form was studied, solution flow rate and resin particle size being varied to cover a modified Reynolds number range of 0·014–4·8. Over a range of 50–75°C the inversion was a first order reaction with an activation energy of 15,950 cal per gram-mole. Observations indicated that the rate of reaction was strongly influenced by diffusion within the resin particles and that external (film) mass transfer was not significant for the range of conditions employed.

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Determination of the strength of the structure of aqueous solutions of sucrose by measurements of the cavitation threshold. P. L. VELIKODNYI and B. V. CHERNOGORENKO. *Sakhar. Prom.*, 1964, **38,** 889–890. The formation of cavitation bubbles in sucrose solutions was induced by ultrasonic vibrations and the strength of the structures expressed by a graph of voltage (on the electrodes of the ultrasonic generator) *vs.* sucrose concentration. The curve had two distinct sections with an inflexion between, corresponding to two different types of structure. Up to 30% concentration, cavitation increased linearly with concentration and the structure of water predominated, somewhat strengthened by the formation of sucrose hydrates containing an indefinite number of water molecules. The strength of the structure was determined by that of the hydrogen bonds formed between the water molecules and the hydroxy groups in the sucrose hydrates. The water has been found to have a quasi-crystalline structure caused by interaction between the water molecules with formation of hydrogen bonds. The sucrose hydrates react with the volumetric water and with themselves, further hydrogen bonds of a different strength being formed. At concentrations above 30% the strength of the structure increases more rapidly than concentration (the number of hydrogen bonds between the sucrose hydrates increasing with concentration) and the structure has the character of a dissolved substance to which a solvent is added whose proportion falls with sucrose concentration. This structure could be broken down only if the voltage on the electrode was increased.

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The structure of saccharates. S. E. KHARIN and I. P. PALASH. *Sakhar. Prom.*, 1964, **38,** 891–895.—U.V. absorption spectroscopy at 206–400 mμ was used in investigations of the structure of mono-, di- and tricalcium saccharates. Full details are given of the saccharate preparation techniques. Monocalcium saccharate, with maximum absorption at 209 mμ, was found to have a structure different from those of di- and tri-calcium saccharates, but not identical with that of binary sucrose-salt compounds, as suggested by other authors. (The maximum absorption of di- and tricalcium saccharates occurred well outside the range of the tests and no conclusions could be drawn regarding their structures.) Saccharates of mono- and disaccharides were also studied.

These had two maxima (at 207–212 mμ and 270–290 mμ) with minima at 240–245 mμ. This pattern was attributed to the presence of colour substances (carbohydrate alkaline degradation products) formed because of the extreme instability of reducing sugar saccharate solutions. The maximum at 207–212 mμ was caused by the chemical bond formed between lime and the reducing sugars. Since it is also the maximum corresponding to the bond between lime and sucrose and hence the bonds are identical, the lime cannot form a bond with the reducing carbonyl group and the reaction is one of displacement, with the carbohydrate acting as a weak acid. This was verified by tests in which lime was combined with monatomic alcohols having the same structure as monosaccharides. It was confirmed that the structures of monocalcium saccharates of reducing and non-reducing sugars are identical.

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The effect of colloids on changes in beet juice viscosity. Viscosity of model systems. J. VAŠÁTKO, J. ŠTUDNICKÝ and A. SMELÍK. *Listy Cukr.*, 1964, **80**, 287–290. The effect of invert sugar, egg albumin, pectin and electrolyte solutions (K_2SO_4, NaCl, $CaCl_2$, $MgCl_2$ and KCl respectively in 10% sucrose solution) on the viscosity of sucrose solutions was studied. The salt solutions had a negligible effect on viscosity, albumin and invert sugar had a moderate reducing effect, while pectin caused a considerable increase in viscosity. Addition of albumin, invert sugar or salt reduced the pectin viscosity in the sucrose solution. Investigation of the interaction between pectin and albumin showed that this was reduced as the degree of esterification of the pectin increased. The fall in the additive viscosity caused by albumin is attributed to the formation of pectin-albumin complexes, the number of which increases with increase in the concentration of the two substances. The presence of low molecular electrolytes reduces the pectin-albumin interaction.

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Chemical mechanism of dampening of refined sugar. II. Reaction of sucrose with water vapour from the viewpoint of chemical kinetics. K. ČÍŽ. *Listy Cukr.*, 1964, **80**, 299–301.—The initial phase in dampening of refined sugar (reaction of water vapour with non-sugars on the crystal surfaces) can be expressed by a 1st order reaction equation: $\ln \frac{a}{a-x} = kt$, where a is the amount of water needed to form a thin layer of saturated syrup on the crystal surface, x is the amount of water reacting in time t, and k is the rate constant. For pure sucrose, k has a value of approx. $1{\cdot}5 \times 10^{-5}$ (sec^{-1}). It is 15–20% lower for refined sugar and can be used as a numerical guide to refined sugar storability. Tests showed the effect of time on the increase in moisture content of pure sucrose, export refined sugar and normal crystal. The maximum moisture content was obtained after a certain time (about 20 min with pure sucrose, 40 min with export and 65–70 with normal crystal) after which the level remained constant. The activation energy of the system was found to be $E = 1{\cdot}3$ kcal/mol/°C (approximately). Values of the rate constant k were calculated for three test temperatures (19, 23 and 28°C) and a graph drawn of k *vs.* temperature.

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Effect of magnesium on clarification and the phosphate content of raw sugars. P. HIDI. *Australian J. Appl. Sci.*, 1964, **15**, 35–40; through *S.I.A.*, 1964, **26**, Abs. 897.—The electrical conductivities of various amounts of $MgCl_2$, Na_2HPO_4, NaCl and ($MgCl_2 + Na_2HPO_4$), dissolved in conductivity water or in solutions of recrystallized sucrose, were measured at 25, 45, 55, 65, 85 and 90°C. From the results the dissociation constant K, for the equilibrium

$$MgHPO_4 \rightleftharpoons Mg^{++} + HPO_4^{--}$$

in a clarified juice, is estimated to be $1{\cdot}6 \times 10^{-3}$ at 90°C and ionic strength 0·1. It is calculated that a 4·5 mM concentration of Mg^{++} ions therefore causes a four-fold increase in the solubility of phosphate. Graphs of the results show that the degree of association of the ions increases with both sugar concentration and temperature. Other factors influencing the solubility of phosphate in juices are briefly discussed.

* * *

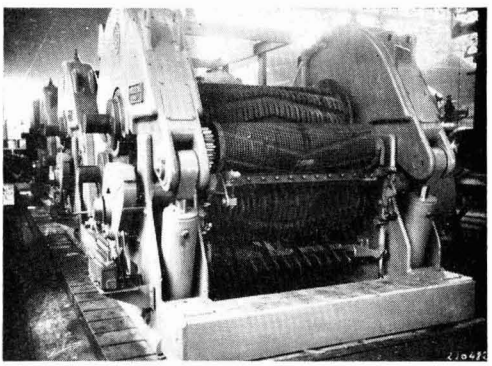
Growth rates of sugar crystals in impure solutions. I. N. KAGANOV and M. S. ZHIGALOV. *Sakhar. Prom.*, 1965, **39**, 16–19.—The results obtained by various authors in studies of sugar crystal growth rate are discussed. These have revealed a linear relationship between growth rate and sugar concentration in the initial stages of crystallization. BRIEGHEL-MÜLLER has shown that at 90 purity and below, the growth rate curve climbs steeply to a maximum, then falls fairly sharply, possibly because of reduction in mass transfer and increase in sucrose solubility under the influence of increasing non-sugars concentration. The retarding effect of non-sugars on crystallization can be approximately expressed as inversely proportional to e^{11z}, where z is the "index of contamination", i.e. the parts of non-sugars by weight to one part of sugar. The strong effect of non-sugar molecules "wedged in" between molecules of crystallizing sugar is attributed to the sharp change in the mutual attraction between the molecules, which in a number of cases is assumed to be equivalent to d^{-6}, where d is the intermolecular distance. The maintenance of concentrations at which maximum crystallization rates are obtained is impossible at high purities because of the formation of new crystals with deposition of false grain. However, knowledge of the rates of crystallization at low purities is very important as regards molasses formation, which is considered from three viewpoints, viz. centrifugal performance, molasses exhaustion and crystallizer efficiency. At 30°C, 60 purity and a non-sugars:water ratio of approx. 3·75, the maximum growth rate obtainable is 0·007 mm/hr, which is considered too slow for purposes of molasses exhaustion under normal factory conditions. This is compared with what Brieghel-Muller considers the limit, i.e. 0·0006 mm/hr at 30°C, a purity of 58·5, Brix of 87·3, non-sugars:water ratio of 2·85 and a viscosity greater than 1500 poises.

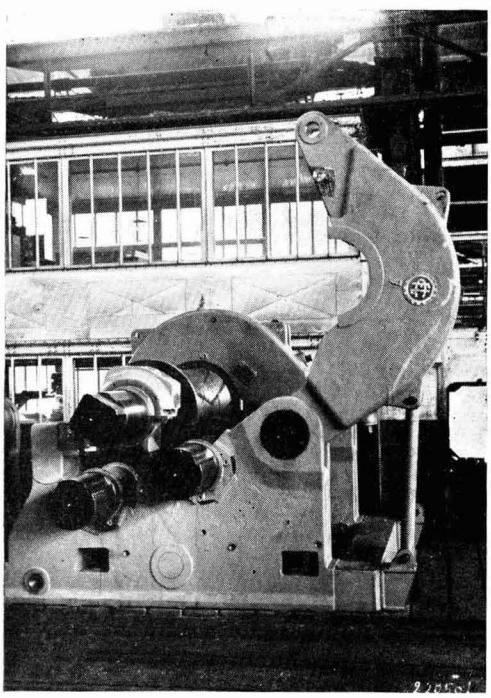
TRADE NOTICES

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.

Moulins à canne (Cane mills). Soc. Fives Lille–Cail 7 rue Montalivet, Paris 8e, France.

In the latest edition of this brochure, which provides information (in French, English and Spanish)





on a number of cane mills supplied to factories in various parts of the world, Fives Lille–Cail have also given details of their latest creation: a patented self-setting mill. As can be seen from the illustrations, the feed roller is located higher than the discharge roller so that as the top roller rises during operation a constant opening ratio is maintained. The advantages claimed for this mill include easy pre-setting of the ratio of feed:discharge opening, easy lifting of the top roller, better extraction, increased capacity, and reduction of power peaks. The illustrations show a tandem of four 28 × 59 in steam turbine-driven self-setting mills which are to be installed in Giohar sugar factory (Somalia).

* * *

In-line rotary pump for viscous liquids. Warren Pumps Inc., Warren, Mass., U.S.A.

Warren's new "Roline" is a positive-displacement, gear-type rotary pump designed for installation right in a line of pipe like a valve, eliminating baseplates and foundations. It is now available for pumping liquids with viscosities up to 100,000 s.s.u. Three sizes have capacities up to 104 g.p.m. with a pressure range of 110-350 p.s.i.g.

Suction and discharge flanges are 300 ASA for proper in-line mounting support. Wide-faced timing gears prevent pumping rotor and rotor to pump body metallic contact. Bearings are life-equalized and rated according to U.S. Standard B-10. Pumps are designed for Nema C-flange motors, drip-proof, enclosed, explosion-proof or epoxy-insulated. Standard pump construction is cast iron; ductile iron and steel are also available.

* * *

Industrial air and gas dryer. Belliss & Morcom Ltd., Icknield Square, Birmingham 16.

This small, compact packaged unit is a fully automatic refrigerant type for dealing with up to 2000 c.f.m. of air or gas at 100 p.s.i.g. and reducing the dewpoint to 36°F. The "Dryaire" uses the refrigeration method which Belliss claim to be cheaper in running costs than other dryers operating on the principle that where moisture is absorbed it has to be evaporated by electric heaters.

Air at 80°F and 100 p.s.i.g., saturated with water vapour, enters the unit and is cooled to 50°F in the pre-cooler. It then passes to the final cooler where it is cooled by refrigerated liquid to 36°F; here the water vapour is condensed and the moisture-laden air is passed through the separator. The condensate is discharged to waste and the air passed back through the pre-cooler where it is re-heated at 74°F by the incoming air and discharged to process. The refrigerant liquid is pumped from the storage tank through the final air cooler, through the chiller and back to the storage tank. The refrigerant liquid is held at 32°F by on/off thermostatic control of the refrigeration compressor. The size of the storage tank and flow rate are so arranged that the refriger-

ation unit will not normally cycle on/off more than once in five minutes. The unit will work efficiently with any flow from zero to the rated maximum throughput. Four sizes of dryers are available for capacities of 350, 650, 1000 and 2000 c.f.m.

* * *

PUBLICATIONS RECEIVED

STANDARD A.C. MOTORS. Mather & Platt Ltd., Park Works, Manchester 10.

A new publication, E 2829, gives full details of the Mather & Platt range of standard A.C. squirrel-cage and slip-ring induction motors up to 1500 h.p., vented and totally-enclosed, all of which are suitable for tropical duty and protected for use in chemical works. Provision is made for fitting heaters on all machines and they are available in metric and inch dimensions. The publication provides information on mountings, winding, terminal boxes, bearings, performance and accessories.

* * *

BUCKET ELEVATORS. Link-Belt Company, Prudential Plaza, Chicago, Ill., 60601 U.S.A.

Book 2914 describes four of the most popular types of bucket elevators, and one sub-type, from the Link-Belt range of 14 basic types. Two types are centrifugal discharge models with adjustable head or foot shafts and the others are continuous discharge types. The book contains application data for selection from among the four types, giving dimensions and specifications, capacities and alternative casing construction materials. Also included is information on chains, sprockets, belts, pulleys, buckets, etc.

* * *

SPECIALISTS IN SUGAR INDUSTRY EQUIPMENT. Plant City Steel Co., P.O. Drawer A, Plant City, Fla., U.S.A.

Illustrations in this leaflet show Plant City Steel installations in four Florida sugar factories, selected from their range of sugar machinery which includes vacuum pans, condensers, cane kickers, evaporators, chutes, cane carriers, bagacilllo drums, ducts, clarifiers, storage tanks, hoppers, bagasse conveyors, air preheaters and steel structures.

* * *

FULTON CANE MILLS. Fulton Iron Works Company, St. Louis, Mo., 63116 U.S.A.

A new and attractive booklet in colour provides information on the modern Fulton inclined-housing cane mills which are described and illustrated in detail, with individual sections devoted to the steel housings, hydraulic top caps, jaw plates, floating top roll scrapers, bottom roll adjustment, turnplates, turnbeams and their adjustment, bottom roll bearings, bedplates, rolls, crownwheels, intermediate carriers, feeder rolls, crusher feeder carriers, mill drives and controls, juice handling, cane knives, lubrication and gear pedestals. The second part of the booklet includes 12 pages of engineering data which should be most useful, providing graphs of h.p. requirements at various crushing rates and fibre content, a nomogram for determining top cap pressure for various roll lengths, ram diameters, etc., crushing capacity for various roll sizes, roll peripheral speeds at different r.p.m. values, roll setting graphs, etc.

* * *

GRANULAR ACTIVE CARBON DECOLORIZATION. Pittsburgh Activated Carbon Company, Grant Building, Pittsburgh 19, Pa., U.S.A.

Two leaflets provide reports on application of decolorization with Pittsburgh CAL granular active carbon, one at the Sucrest Corporation refinery at Chicago, and the other at the Houma, Louisiana, refinery of Southdown Inc. In both cases, after successful pilot plant trials, the existing two-stage powdered carbon process was replaced by continuous column CAL decolorization. Efficiency of colour removal is 85% and 90%, respectively, at the two refineries, and carbon losses on reactivation 2½% and 5%. Cycles at Chicago run 8 weeks and at Houma between 16 and 30 days depending on the raws handled. A significant benefit is the reduction in product loss in press cake.

TURBINE GENERATORS—MUNICIPAL AND INDUSTRIAL. Worthington Corporation, Turbine Division, Wellsville, N.Y., 14895 U.S.A.

Illustrations are provided of the wide range of types of Worthington turbine power generator described in this booklet with sectional diagrams and photographs of the various components—casings, diaphragms, blades and wheels, turbine rotors, shaft packing and bearings, lubrication, governor and nozzle controls, etc., generator stator frame and coils, rotor, bearings and exciter. Also available is a range of geared turbine-generators up to 1500 kW.

* * *

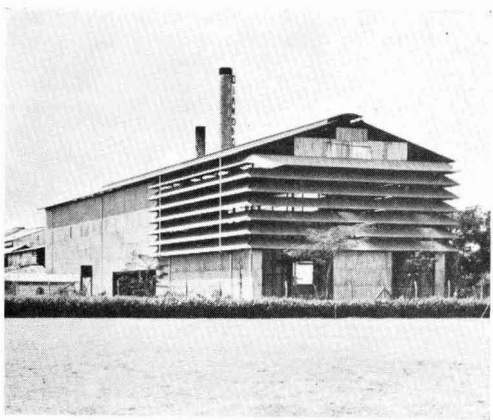
Fletcher & Stewart cane machinery for Colombia.—Orders for sugar cane plant worth £1,100,000 have been received by Fletcher & Stewart Ltd. from Colombia. Two five-mill cane tandems are to be provided for the Providencia and Castilla sugar factories as well as other plant and handling equipment. The orders bring the Company's total exports to Colombia during the past two years to more than £2,500,000, which includes a recent £400,000 order for equipment for Rio Paila sugar factory.

* * *

Irrigation pumps for Tanzania.—Irrigation is playing a big part in the establishment of the 25,000 acre Kilombero sugar project in the Great Ruaha Valley, 200 miles west of Dar-es-Salaam, where 4500 acres have so far been reclaimed from the bush and a sugar factory has been established. A total of 56 diesel engine-powered pumps, mostly horizontally split casing units, have been supplied by Sigmund Pulsometer Pumps Ltd. These pumps, with capacities up to 460 g.p.m. against heads of up to 298 ft, supply the network of canals feeding an overhead spray irrigation system.

* * *

Sugar mill reconstruction in British Guiana.—The illustration shows the new factory recently erected by Taylor Woodrow (Overseas) Ltd. for the Demerara Co. Ltd. at its Diamond Estate, near Georgetown. Production is to be stepped up to meet the rapid expansion of cane cultivation on both the Company's own estates and on the private cane farms. Work



involved the erection of a building 300 ft long with an 80 ft span and eaves height of 55 ft. The frame of the building supports the crane rails for two 20-ton, 50 ft high electric travelling gantries. These will have a dual purpose; lifting the heavy machinery of the mills and unloading the sugar cane direct from barges. The latter operation has been made possible by extending the canal system into the interior of the building.

The late Dr. P. HONIG

ON the 15th May the sugar industry lost one of its giants and this Journal one of its most valued friends. Dr. PIETER HONIG, the distinguished sugar consultant and author, died at his home in Elmsford, N.Y.

Dr. HONIG was born in 1899 at Schermerhorn in northern Holland and went to school in Alkmaar. He graduated as a chemical engineer from Delft Technical University in 1921 and became a research chemist and technologist for the Algemeene Norit Mij., carrying out investigations on absorption in the sugar industry as well as the refining of oils, alkaloids and petroleum derivatives. In 1925 he was awarded the doctorate of the Delft Technical University for his work on comparative studies of adsorptive carbons, and a year later was appointed Director of the Chemical Dept. of the Java Sugar Industry Experiment Station.

Here he led a team which was probably the most active in the world at that time in studying sugar problems, producing many reports which appeared in the *Archief* and *Mededelingen* of the Station. In 1941 he became Director of the Rubber Research Institute in Java, a year later going to the Dutch Embassy in Washington as Commissioner of the Dutch East Indies.

After the war he returned to Java as Director of the Organization for Scientific Research which was intended to rehabilitate the research institutions damaged or destroyed during the war. He left the Dutch East Indies in 1948 to go to the United States, where he became Technical Research Director of the West Indies Sugar Corporation. He left this post in 1958 to become an independent consultant, working from his home in Elmsford but travelling in many countries — Peru, Iran, Canada, etc.—although this had been curtailed of recent years as a result of ill-health.

Dr. HONIG's contributions to the literature of sugar technology are recorded in publications all over the world, most recently among the I.S.S.C.T. 12th Congress papers, and it was for his outstanding work that the Sugar Industry Technicians Inc. honoured him at its 24th Annual Meeting only a few days prior to his death.

But as a monument, PIETER HONIG leaves the three volumes of his "Principles of Sugar Technology" which have proved, and will continue to be, an enduring work of reference for the sugar industry.

Brevities

Bolivian sugar surplus[1].—Sugar production in 1964 amounted to 103,000 tons, raw value, compared with 75,509 tons in 1963 and 54,648 tons in 1962. This was caused by the expansion of the cane area and increase of the sugar factory capacities. At present domestic requirements amount to 80,000 tons, leaving a surplus of 23,000 tons. In 1965 there will be a decrease in the cane area and an increase in domestic consumption which is expected to reach 27·8 kilos per caput, as compared with 21·7 kilos in 1962. Sugar production is expected to rise in 1966, however, when the sugar factory being built in Bermejo, Dept. of Tarija, is complete ; it is expected to produce about 4000 tons of sugar.

New sugar mill for the Philippines[2].—A new sugar mill, with a capacity of 6000 tons of cane per day, will be constructed by a Japanese firm with the assistance of engineering specialists from Victorias Milling Company, in Kabankalan, Negros Occidental. The new central will be known as the Southern Milling Corporation.

* * *

Norway sugar imports[3].—Imports or sugar by Norway during 1964 totalled 105,502 metric tons, raw value, as compared with 209,308 tons in 1963. As before, the principal supplier was Great Britain, with other important amounts from Denmark, Poland, Czechoslovakia and East Germany.

[1] F. O. Licht, *International Sugar Rpt.*, 1965, **97**, (6), 14.
[2] *Sugarland* (Philippines), 1964, **1**, (11), 51.
[3] F. O. Licht, *International Sugar Rpt.*, 1965, **97**, (6), 9.

World Sugar Import Requirements, 1965[1]

FREE MARKET	metric tons, raw value 1st estimate	2nd estimate
Country or Area		
EUROPE		
Albania	11,000	11,000
Bulgaria	40,000	50,000
Cyprus	16,000	16,000
Finland	155,000	144,500
Germany (West)	85,000	100,000
Gibraltar	2,000	3,000
Greece	82,000	75,000
Iceland	9,000	11,000
Ireland	19,000	25,000
Italy	375,000	165,000
Malta	15,500	15,000
Netherlands	110,000	45,000
Norway	160,000	160,000
Portugal (incl. terr.)	55,000	55,000
Spain (incl. terr.)	300,000	250,000
Sweden	57,000	65,000
Switzerland	230,000	210,000
United Kingdom	2,050,000	1,985,000
U.S.S.R.	1,600,000	1,600,000
Yugoslavia	70,000	70,000
TOTAL	5,441,500	5,055,500
NORTH AMERICA		
Canada	735,000	735,000
TOTAL	735,000	735,000
CENTRAL AMERICA		
Bahamas and Bermuda	6,000	6,000
Honduras	500	3,000
Panama Canal Zone	2,000	2,000
Virgin Islands (U.K.)	400	400
TOTAL	8,900	11,400
SOUTH AMERICA		
Chile	190,000	210,000
Uruguay	55,000	50,000
TOTAL	245,000	260,000
ASIA		
Afghanistan	45,000	45,000
Arabian Peninsular:		
Aden, Colony & Protectorate	29,000	33,000
Saudi Arabia & others	120,000	140,000
Brunei	4,000	4,000
Burma	30,000	50,000
Cambodia	19,000	19,000
Ceylon	219,000	225,000
China (Mainland)	500,000	700,000
Hong Kong	88,000	76,000
Iran	250,000	300,000
Iraq	250,000	275,000
Israel	78,000	70,000
Japan	1,300,000	1,300,000
Jordan	54,000	54,000
Korea (North)	20,000	20,000
Korea (South)	53,000	60,000
Laos	4,000	4,000
Lebanon	40,000	35,000
Malaysia:		
Malaya	225,000	225,000
Sabah	13,500	14,000
Sarawak	18,500	19,000
Singapore	77,000	80,000
Mongolia	15,000	15,000
Nepal	6,000	7,000
Pakistan	50,000	150,000
Syria	70,000	75,000
Vietnam (North)	20,000	20,000
Vietnam (South)	50,000	55,000
TOTAL	3,648,000	4,070,000
AFRICA		
Algeria	240,000	240,000
Cameroon	10,000	10,000
Central African Republic	3,000	3,000
Chad	18,000	18,000
Congo (Leopoldville)	5,000	20,000
Dahomey	10,000	10,000
Gabon	1,000	1,000
Gambia	5,000	5,000
Ghana	38,000	42,000
Guinea	10,000	10,000
Ivory Coast	30,000	26,000
Kenya	71,500	69,000
Liberia	3,000	3,000
Libya	29,000	35,000
Mali	27,000	27,000
Malawi	18,000	18,000
Mauritania	22,000	20,000
Morocco	400,000	400,000
Niger	12,000	7,500
Nigeria	80,000	40,000
Senegal	70,000	68,000
Sierra Leone	22,000	22,000
Somalia	0	27,000
Sudan	135,000	135,000
Tanzania	1,500	1,500
Togo	5,000	5,000
Tunisia	90,000	90,000
Upper Volta	10,000	13,000
U.A.R. (Egypt)	95,000	120,000
Zambia	15,000	22,000
TOTAL	1,476,000	1,508,000
OCEANIA		
New Zealand	124,000	124,000
U.K. Admin. Oceania	3,000	3,000
U.S. Admin. Oceania	4,000	4,000
Western Samoa	4,000	4,000
TOTAL	135,000	135,000
TOTAL FREE MARKET	11,689,400	11,774,900
U.S. MARKET		
U.S.A. net import requirements from foreign countries	3,075,000	3,300,000
GRAND TOTAL	14,764,400	15,074,900
Allowance (2%) for possible underestimates, supplies for ships stores and unexplained disappearance of sugar	295,300	301,500
GRAND TOTAL	15,059,700	15,376,400
GRAND TOTAL ROUNDED	15,060,000	15,376,000

[1] Int. Sugar Council 2nd estimates, 29th April 1965.

BREVITIES

Cuba-Morocco trade agreement[1].—Cuba will sell Morocco 565,000 tons of sugar in the next two years under a trade agreement signed in Havana. The agreement provides for additional supplies if Morocco requires them. Morocco will supply Cuba with phosphates and raw materials. The price that Morocco will pay for the sugar under the agreement is 3·25 cents per lb, according to official Cuban sources in London.

* * *

Japanese sugar purchases.—As a result of recent negotiations, a total of 550,000 tons of Queensland raw sugar has been sold to Japan for delivery during the period July 1965 to June 1966[2]. Based upon present estimates, these major sales, together with other commitments, have now largely disposed of Queensland's exportable surplus from the 1965 crop. A Japanese group has also contracted to buy 325,000 tons of Natal raw sugar for shipment in the same period[3]; 190,000 tons are to be shipped before the end of this year. A third group has contracted to buy a total of 330,000 tons of raws from Cuba on the same shipment and pricing terms (based on the London daily price or London terminal price at buyers' option) as for the other purchases.

* * *

Czech sugar plants for Indonesia[4].—Under an agreement on economic co-operation between Czechoslovakia and Indonesia, several factories will be supplied by Technoexport. Construction of a sugar refinery has begun at Bone, in Sulawesi district, Celebes.

British Guiana cane sabotage.—Reports have been received[5] of the dynamiting of a giant aqueduct with consequent threat of flooding of thousands of acres of cane on the Booker-owned Uitvlugt estate. At another estate, Enmore, more than 20 acres of cane were set on fire; at a third Booker estate another fire was soon extinguished. The situation following the strike called by the Guiana Agricultural Workers Union was said to have deteriorated but three of the five factories closed by the strike had resumed crushing.

* * *

U.K. beet sugar production 1964/65.—Provisional figures published by the British Sugar Corporation reveal a record output of 925,000 long tons, white value, from 6,218,000 long tons of beet. The beet tonnage was almost 1 million tons below the record quantity sliced in 1960/61, but higher root weights (an average of 684 g) and sugar contents (averaging 17·72%) contributed to the excellent results. The weather conditions were extremely favourable for beet growing and harvesting and for delivery to the factories.

* * *

New sugar factory for Nepal[6].—A new sugar mill was inaugurated at Birganj in Southern Nepal recently. The mill has a crushing capacity of 1000 tons of cane per day and has been built with aid from the Soviet Union. Sugar production from the current season is provisionally estimated at 5500 long tons and it is hoped to double this figure next season. A 1000-acre estate attached to the mill is cultivated with cane and by next year it is planned to extend this to 5000 acres.

* * *

Trinidad sugar production, 1964[7].—Sugar production from the 1964 crop amounted to 226,531 tons, compared with 227,346 tons in 1963. Harvesting of the 1964/65 crop began in the last week of December and sugar production for 1965 is estimated at 250,000 tons.

* * *

Cuban sugar production[8].—Cuba would produce six million tons of sugar by the 10th June, Premier FIDEL CASTRO said in a May Day speech in Havana. The country had already produced 5,160,000 tons by dawn on 1st May, he revealed.

* * *

Dominican Republic sugar shipments delay[9].—The revolution in the Dominican Republic has delayed sugar shipments. Harvesting and crushing in some areas have also been halted and sugar production from this year's crop will probably fall below last season's outturn of about 970,000 short tons. Even before the revolution took place, drought and strikes had hindered sugar operations. About 250,000tons of San Domingo sugar apparently remains to be shipped to the U.S.A. under her current 1965 quota of 398,323 tons, of which about 125,000 tons are scheduled to arrive during the third quarter of the year.

* * *

French sugar production plans[10].—The French Government has fixed the 1965/66 target at 1,569,000 tons, compared with a crop of 2,150,000 tons in 1964/65 and the sugar trade organizations' proposals of a 1965/66 crop output of 1·87 million tons. A spokesman for the French beet growers said that while the government decision was not altogether unexpected, it was now practically impossible to cut back on the projected output since the vast majority of growers had gone ahead with sowing based on a 1·87 million ton crop.

Stock Exchange Quotations

CLOSING MIDDLE

London Stocks (*at 17th May* 1965)	s d
Anglo-Ceylon (5s)	5/7½
Antigua Sugar Factory (£1)	9/6
Booker Bros. (10s)	18/6xd
British Sugar Corp. Ltd. (£1)	22/4½
Caroni Ord. (2s)	2/3
Caroni 6% Cum. Pref. (£1)	16/3
Demerara Co. (Holdings) Ltd.	4/1½
Distillers Co. Ltd. (10s units)	23/–
Gledhow Chaka's Kraal (R1)	15/6xd
Hulett & Sons (R1)	23/6
Jamaica Sugar Estates Ltd. (5s units)	3/9
Leach's Argentine (10s units)	16/–
Manbré & Garton Ltd. (10s)	31/4½
Reynolds Bros. (R1)	15/6xd
St. Kitts (London) Ltd. (£1)	13/–
Sena Sugar Estates Ltd. (5s)	6/9
Tate & Lyle Ltd. (£1)	35/1½
Trinidad Sugar (5s stock units)	2/4½
West Indies Sugar Co. Ltd. (£1)	9/9

CLOSING MIDDLE

New York Stocks (*at 17th May* 1965)	$
American Crystal ($5)	18⅞
Amer. Sugar Ref. Co. ($12.50)	22
Central Aguirre ($5)	22⅞
Great Western Sugar Co.	40¼
North American Ind. ($10)	14⅛
South P.R. Sugar Co.	27
United Fruit Co.	21¼

[1] *Public Ledger*, 27th February 1965.
[2] C. Czarnikow Ltd., *Sugar Review*, 1965, (702), 45.
[3] *Public Ledger*, 6th March 1965.
[4] F. O. Licht, *International Sugar Rpt.*, 1965, **97**, (5), 6.
[5] *Public Ledger*, 27th March 1965.
[6] C. Czarnikow Ltd., *Sugar Review*, 1965, (703), 53.
[7] F. O. Licht, *International Sugar Rpt.*, 1965, **97**, (5), 12.
[8] *Public Ledger*, 4th May 1965.
[9] B. W. Dyer & Co., *News Matter*, 5th May 1965.
[10] *Public Ledger*, 3rd April 1965.