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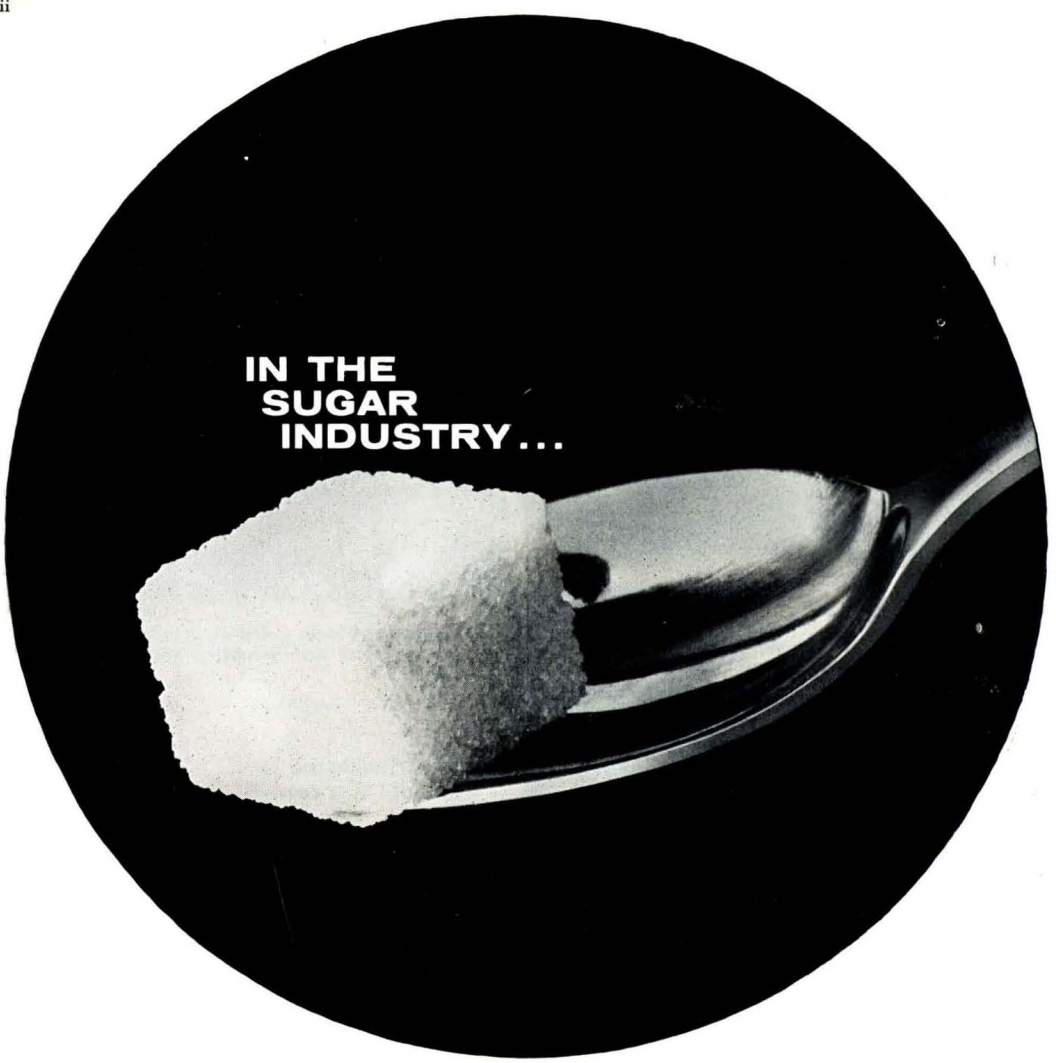

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THE
INTERNATIONAL SUGAR JOURNAL

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NOTES AND COMMENTS

Sugar and heart disease.

Dr. J. YUDKIN, Professor of Nutrition and Dietetics in the University of London, recently published an article[1] in the British medical journal, "The Lancet", which purported to indicate a possible causal relationship between sugar consumption and ischaemic heart disease. Such an article might normally have been allowed to remain unnoticed by the general public and the sugar industry; however, further publicity has been given to the proposition by a radio broadcast and a press conference given to newspapers. Consequently it might be as well to examine the evidence reported.

Prof. YUDKIN had first drawn attention to the close parallel between the rise in fat and sugar intakes with increasing income per caput for 41 countries, using F.A.O. data. He then examined the relationship between sugar consumption of hospital patients with heart disease and that of a control group, including other patients having accidental injuries and apparently healthy subjects. All were men between the ages of 45 and 66. From the figures obtained he deduces that there were significant differences between the sugar intakes of the groups and that it is likely to be a primary causal relationship. From this premise he is then quoted[2] as making the following statements: "More than 100,000 lives a year could be saved if everyone gave up sugar . . . Death lurks in a tea cup . . . The less (sugar) you eat the safer you are".

But, examining the evidence more closely suggests that these statements, and even the basic premise, are not supported. First, the groups themselves numbered only 25 individuals—a tiny sample on which to base such claims. Second, sugar consumption measured was only that taken as crystal sugar in tea, etc. and the possibility of error in relating this to the total sugar intake in other foods, while admitted, is ignored. Third, Prof. YUDKIN had made the complaint that in studies on the relationship between fat consumption and heart disease, other factors such as sugar consumption had been ignored; here he has related sugar and heart disease and himself ignored all other factors. Fourth, even if a relationship had been firmly established (and we would not agree that it has), it is still a matter for conjecture whether high sugar consumption causes the heart disease or *vice-versa*.

It might be best to conclude merely that the evidence put forward does not justify the extreme statements attributed to Prof. YUDKIN at the press conference which, the *Daily Telegraph* notes, was "organised by the manufacturers of a new type of saccharine".

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U.K. sugar surcharge.

The Sugar Board surcharge of 2½d per lb (23s 4d per cwt) was increased to 3d per lb (28s 0d per cwt) from the 28th July, in order to bring the Board's trading position more into line with the current level of world prices.

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European sugar beet acreage.

F. O. Licht K.G. have recently published their second estimate of beet acreage for the 1964/65 campaign[3]. The total for Eastern and Western Europe is 7,236,332 hectares, as compared with 6,281,167 for the last campaign. This is an increase of 15·21% but is a decrease of 343,168 ha on his first estimates in April[4]. This is largely due to a drop of 300,000 ha in the estimate for the U.S.S.R., 39,000 ha for Czechoslovakia, 30,000 ha for Yugoslavia, 23,000 ha for France and 20,000 ha for Italy, while the estimate for Hungary is 12,000 ha higher. Only minor changes are estimated for other countries.

* * *

World sugar production estimates[5].

World production of centrifugal cane and beet sugar for 1963/64 is estimated at 59,491,000 short tons, raw value, according to the Foreign Agricultural Service of the U.S. Dept. of Agriculture. This compares with 54,893,000 tons for the 1962/63 crop, an increase of 4,598,000 tons or approximately 8·4%.

World production of non-centrifugal sugar is estimated at 6,870,000 tons for the 1963/64 crop

[1] *Lancet*, 4th July, 1964.
[2] *Daily Telegraph*, 17th July, 1964.
[3] *International Sugar Rpt.*, 1964, **96**, (20), 1–5.
[4] *I.S.J.*, 1964, **66**, 173, 208.
[5] *Lamborn*, 1964, **42**, 111.

as against 7,092,000 tons produced in 1962/63, a decrease of 222,000 tons or approximately 3·1%.

"Indications point to a substantial further increase in the world sugar crop in 1964/65. Weather conditions, so far, have been generally favourable in most important countries, and beet acreages were increased significantly this year in both West and East Europe, with a particularly large increase being reported by the U.S.S.R. Cane sugar production is also expected to increase substantially in 1964/65."

* * *

U.S. domestic sugar crops[1].

The 1963 sugar beet production of 23,352,000 tons —the third successive record high—was 28% larger than the 1962 crop of 18,254,000 tons and was obtained from an area of 1,236,300 acres, as opposed to 1,103,000 acres in 1962. The yield of 18·9 tons per acre was 2·4 tons higher than the previous year's yield and exceeded the record set in 1959 by 0·1 ton. Record yields were harvested in all major central and Western states except Kansas and California.

Sugar cane harvested for sugar set a record high, at 23,034,000 tons, exceeding the production of a year earlier by almost 4 million tons. Most of the increase was on the mainland, where the area was up 19% at 439,000 acres compared with 368,600 acres and the average yield was higher at 29·6 tons/acre compared with 25·4.

Production of beet and cane sugar amounted to 5,385,000 tons, raw value, an increase of 18% from 1962. This production consisted of 3,101,000 tons from beets and 2,284,000 tons from cane. Production of beet sugar was 515,000 tons greater than the previous record output of a year earlier. Cane sugar production was 312,000 tons greater than in 1962, with record production in both Louisiana and Florida. The Hawaiian sugar output of 1,101,000 tons was the third highest on record, surpassed only in 1955 and 1962.

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U.S.S.R. beet cultivation[2].

Sugar beets are grown in nearly all agricultural zones of the Soviet Union. Districts favourable to the cultivation of sugar beets are, in order of yields, Moldavia, Kirgiziya, the Ukraine and also the North of the Caucasus area and the districts of the central Black Earth zone. In 1913 only 630,000 hectares were cultivated with sugar beets in the whole country, rising to 1,200,000 ha in 1940, 1,500,000 ha in 1953, 2,500,000 ha in 1958 and 5,700,000 ha in 1963. Of this last figure, 3,300,000 ha were devoted to beets for sugar production and 2,400,000 ha to beets for fodder.

According to the Seven-Year-Plan, sugar production is to be increased to 9·25–10 million tons, the area being increased to 4·4 million ha.

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Colonial Sugar Refining Co. Ltd., 1964 Report.

Raw sugar milling.—During the 1963 season production of raw sugar by the C.S.R.'s seven Australian mills and the four Fiji mills of its subsidiary, South Pacific Sugar Mills Ltd., was a record 652,000 tons. It had been 598,000 tons for the previous season. Both the Fiji and Queensland milling divisions made production records. It is estimated that in 1964 the mills as a whole will make about 116,000 tons more than in 1963.

The company's Australian mills produced 353,000 tons of raw sugar in 1963. This was slightly better than the previous (1962) record.

Mechanical harvesting of cane has advanced considerably. In 1963, in Queensland, 24% of the cane sold by farmers to C.S.R. mills was mechanically harvested compared with 13% in 1962; at one mill the proportion was 43%. There will be a further increase in 1964.

For 1964 the areas of cane for harvest and sale to the mills will be larger, and estimated production is 448,000 tons. Milling capacity is being expanded and the production objectives for 1965 and 1966 are greater than for 1964. Heavy capital expenditure will continue for some time.

South Pacific Sugar Mills Ltd. had a very successful 1963 season; all available cane was crushed and the four mills produced a record 299,000 tons of raw sugar.

As part of a continuing programme of expansion, substantial increases have been made in milling capacities for 1964, and production from the crop now being harvested is expected to be about 320,000 tons of raw sugar, about 20,000 tons more than in 1963.

There will be further expansion of the industry during the next two years. The acreage cultivated for cane will increase materially. There will be large capital expenditure to raise the capacities of transport, milling and sugar storage.

Refined sugar.—Sales of refined sugar products from the Australian refineries for the year ended 31st March 1964 were 554,000 tons, 1·3% more than in the previous year. The New Zealand Sugar Company sold 118,000 tons, 3·3% less than in the previous year. Manufacturing customers, who buy about 54% of Australian refined sugar, are taking increasing quantities in the form of bulk granulated and liquid sugar.

Much new equipment has been installed in recent years, including machines and instruments which make for more semi-automatic control. The capital expenditure is helping to reduce unit costs, to improve the quality of the products, and to make the refineries pleasanter and safer places to work in.

Building materials and chemicals.—Sales of C.S.R. building materials have increased. There is some excess manufacturing capacity in Australia for many of the products made, and competition is strong, but profits have improved materially.

Sales of industrial chemicals and plastics from the factories of C.S.R. Chemicals and its associated companies have increased and production generally is now higher than ever before.

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[1] *Willett & Gray*, 1964, **88**, 257–258.

[2] F. O. Licht, *International Sugar Rpt.*, 1964, **96**, (17), 12–13.

CANE GROWING IN THE SUDAN

By H. G. J. LINDEBLAD, Agricultural Adviser
and MOHAMED EL GHALI SULEIMAN, Agricultural Manager
(Guneid Sugar Factory, P.O. Box 29, Hassa Heissa, Republic of the Sudan.)

SUGAR cane is grown on the flat clay plains of the Northern Sudan. One factory (Guneid Sugar Factory) is located on the right bank of the Blue Nile, while the other (Khashm El Girba Sugar Factory) will be on the left bank of the Atbara River, both at a latitude of 15° N.

Guneid Sugar Factory completed its second campaign in May 1964, and Khashm El Girba Factory is planned to start its first campaign in January 1966. Both factories have a capacity of 4000 tons of cane per day, to be harvested from 22,000 feddans (1 feddan = 1·038 acre = 0·42 hectare).

Soil

The soil is a heavy alkaline, montmorillonitic clay which cracks severely, has a pH of 8·2–9·6, and is impermeable, with no lateral movement of water. During a long winter fallow, these soils crack so deeply that they might be said to plough and sub-soil themselves, and in planting cane only the furrows need to be made.

Irrigation

With a yearly rainfall, July-October, not exceeding 15 inches (380 millimetres), furrow irrigation is applied the whole year round.

The Khashm El Girba cane fields will get water from the new dam in the Atbara River, completed in 1964, through a canal 75 kilometres long. The Guneid Sugar Factory uses a pump scheme, with 4 diesel-driven pumps of 2·8 cubic metres per second duty, and 3 electrically-driven pumps of 4·0 cubic metres per second. The Blue Nile water contains only 80–160 p.p.m. dissolved solids.

Water is supplied only during daylight at intervals of 12 to 16 days and in a total amount of 9,000 to 11,000 cubic metres per feddan.

Cane Varieties

Many varieties have been tried out and, under the arid conditions prevailing for most of the year, the best varieties have so far proved to be N:Co 310, Co 281, Co 527, Co 453, CP 44/101, and N:Co 293.

Cultivation

After plant cane, only 2 ratoons are cut, with a long fallow period after the second ratoon.

After the fallow the fields are not ploughed, but directly furrowed at a depth of 10 inches. The furrow spacing is 120 cm for cane fields to be harvested by hand, and 160 cm for fields to be harvested mechanically.

Seed cane setts with 2 buds are planted by hand at a depth of 10–15 centimetres, and only lightly covered. Hot water treatment is not yet necessary, but dipping of the setts in a $\frac{1}{4}$% "Aretan-6" solution is used for quicker and more vigorous germination in winter time.

Fertilizers

Fertilizers are very expensive in the Sudan, and amount to 40% of the cost of the cane.

Field experiments showed no response to phosphate and potash, but the need for nitrogen has been found to be very high, up to 1000 kg of ammonium sulphate per hectare (900 lb per acre).

The influence of nitrogen dressings on the sucrose content of the cane is extremely small, and the optimum dressing for cane yield practically coincides with that for optimum sugar yield. Application of farm yard manure was not successful.

Pests

The Dura or Sorghum moth borer, *Sesamia cretica* Lederer, was a serious pest in the first cane plantings on virgin soil, with infestations up to 100%. This stalk borer has been brought under biological control by the egg parasite *Platytelenomus hylas* Nixon, and the infestation is now less than 2% in milling cane. Plantings of *Dolichos lablab* L. and of *Crotalaria juncea* L. near the cane fields enhance the activities of the parasite.

Termites cause some damage in the young plant cane. Combating the termites with chlorinated hydrocarbons showed no promise because of a lack of sufficient residual effects in the highly alkaline soils.

The red billed weaver bird or Sudan Dioch (*Quelea quelea*) is a minor pest during the breeding season, September-October.

Diseases

Red rot fungus is present, but attacks the resistant varieties only where the stalk is damaged by a growth split or stalkborer hole. Some *Fusarium* (Pokkah Boeng) has been observed.

Some observations on the sugar cane mealy bug, *Saccharicoccus sacchari*, with special reference to varietal preference. ABDUL KAREEM *et al. Madras Agric. J.*, 1963, **50**, 163–164.—The degree of infestation was found to rise to a peak in August, falling abruptly to a minimum in September. Of 8 varieties under observation Co.527 was the most susceptible to attack by *S. sacchari* and Co.726 the least.

CANE RESEARCH IN SOUTH AFRICA

South African Sugar Association Experiment Station, Mount Edgecombe, Natal, Report for 1962–63.

AS pointed out in the Chairman's foreword, the immediate aims of the Station include a substantial increase in the number of seedlings raised by the plant breeder and a changed procedure in regard to disease testing of seedlings, also an increase in research on disease, especially virological research, and in entomology and the physiology of the sugar cane plant. Developments in the advisory and extension services are also envisaged.

An improved staff situation during the year allowed increased attention to be given to agronomic research. A notable research development was the use for the first time in South Africa of radio-isotopes for the study of problems in sugar cane nutrition. In the middle of 1962 a new pest of sugar cane was located on an estate in Swaziland. It was followed by other outbreaks. The damage to cane was similar to that caused by froghopper. This sap-sucking insect was identified as *Numicia viridis* Muir. Trials showed that the pest could be killed with "Malathion" insecticide and a single application of a 5% dust applied by aircraft gave adequate control in all affected fields. A considerable amount of work remains to be done on the ecology of *Numicia* before the most effective and economical method of eradicating or controlling the pest is found.

In his general report the Director of the Station referred to the increasing need to develop a better understanding of the more fundamental aspects of crop environment relationships, if the full potential of the crop is to be exploited in a rational and controlled manner. He pointed out the year has "seen very considerable developments in this direction and although many of the results to date serve mainly to indicate the complexity of the issues involved, tangible progress has nevertheless been made on several fronts. This has been achieved mainly as a result of the 'project' approach to specific aspects of research, whereby all the different disciplines involved are brought into the investigation at the outset in the planning stage and at all appropriate stages thereafter until its completion. A number of such co-operative projects are now in progress involving members of three, four, or more of the various sections and the enthusiasm and interest they have already generated augurs well for the future. This approach has not only been adopted for new projects but the scope of a number of established long-term experiments has also been re-examined and the treatments of the recordings modified so as to give a wider range of information than heretofore."

The report is divided into various sections, viz.—Soils, Plant Nutrition, Cultural Practices, Cane Varieties, Diseases, and Pests. Intensive laboratory investigations are said to be in progress "to assess the characteristic infiltration rates and available water holding capacities of the various soils in the cane belt. The effect of cultural practices, such as trashing, on crumb structure, which has an important bearing upon infiltration and drainage, are being studied along with further investigations on compaction.

Further results obtained from fertilizer trials have once again emphasized the need for adequate water supplies if the full responses to applications of fertilizers are to be achieved. Drought or excessive age of crop accompanied by lodging can all too readily reduce the beneficial responses discernible in the early stages of crop development to negligible proportions at harvest.

The urea *versus* sulphate of ammonia trials conducted during the year once again produced inconclusive results and gave no cause to alter the existing recommendations on the choice of nitrogenous fertilizers.

The review of past work on the effects of trash management on crop yields taken in conjunction with recent developments in crop nutrition/soil moisture relationships of the crop, and the information on soil temperatures accumulated during the last two years, have thrown considerable light on the rôle of trash in crop production. Somewhat surprisingly to many, no doubt, the benefits derived from the presence of trash are mainly related to its physical effects on the soil rather than to its nutritional contribution to the crop, which appears to be negligible.

The results from a time-of-cutting trial conducted both on dry land and land under irrigation are of considerable interest at the present time in that they give clear indications that, with certain reservations, more efficient cane and sucrose production is likely to be realized by cutting cane at or about 12 months of age than at more extended intervals between harvests. The application of these findings to the present needs for intensification of production should clearly not be overlooked wherever conditions favour good growth.

A survey carried out during the year failed to reveal widespread zinc deficiencies in the cane belt. "Zinc deficiency symptoms have so far only been apparent in cane grown in the mist belt areas and here, on observation trials, responses to applied zinc sulphate have been quite common where leaves showed a zinc content of less than 15 p.p.m.

"With regard to the variety programme the first of the varieties to be issued for pre-release trials have in the event failed to live up to their original promise and have in consequence been withdrawn. Two new varieties 'Saraband' (N.51/168) and 'Sabre' (N.51/539) were scheduled for release in September 1963. The present indications are that yet another Natal variety, 'Samson' (N.53/216), and probably at least one of the two introduced varieties C.B.36/14

and C.B.38/22 will find places in the industry during 1964. 'Samson' has on present showing considerable potential for mist belt conditions where in trials with N:Co 376 it has given yields of 146% of the N:Co 376 yields as a plant crop. Other promising varieties are now emerging in increasing numbers from the selection line."

Herbicide trials involving the use of some 17 weedkillers were conducted during the year. Six of the most promising were selected for use in a series of nineteen regional trials which were established throughout the cane belt from Port Shepstone to Umfolozi. These covered most of the major soil types and a wide range of environmental conditions and weed populations. Three subsidiary trials to investigate particular properties of contact herbicides were also carried out.

F. N. H.

THE SUGAR CANE IN VENEZUELA

Boletines (61-68) de la Estación Experimental de Caña de Azúcar de Occidente, Maracay, 1963.

EIGHT bulletins, in mimeographed form and of foolscap size, bound together, deal with various aspects of sugar cane agriculture in Venezuela. The areas devoted to commercial sugar cane cultivation in Venezuela are not continuous, being separated from one another by mountain ranges and other natural barriers. In altitude they range from sea level to 3000 feet. About half the estates are in narrow river valleys, with soil mainly river alluvium. Most of the soils are of good fertility but often shallow. Rainfall is low, for sugar cane, and irrigation is practised. The wet and dry seasons of the year are well defined. About two thirds of the total rainfall occurs from July to December. Cropping is more or less continuous throughout the year.

In a paper by H. F. CLEMENTS (*Boletín* 64), presumably several years old, cultivation and cultural practices in Venezuela are contrasted with those in Hawaii. Phosphate requirements of sugar cane in different soils is dealt with in a paper by C. H. BURLEIGH (*Boletín* 61). Another paper relating to soils (*Boletín* 65) by C. FRANCO, also several years old, deals with the improvement of clay soils for cane in Venezuela. Recommendations include the use of *Crotalaria* as a green manure or soiling crop. Other papers are concerned with the effect of flowering on the moisture content of the leaf sheath (*Boletín* 63 by L. GARCÍA LOZA).

Sugar cane production in Venezuela is severely handicapped by pests and diseases. It is not surprising therefore that three different bulletins should be devoted to insect pests. In the past mosaic disease has probably been the greatest single factor restricting the production of ratoon cane. Damage by borer (*Diatraea*) has long been a serious source of loss in Venezuelan sugar plantations, the extent of damage varying from place to place. One of the papers (*Boletín* 66 by P. GUAGLIUMI) gives an account of investigations on this pest in the Turbio valley. A map shows the locations in the valley where colonies of the Amazonian parasite, *Metagonistylum minense*, were liberated in the effort to control the borer. A marked reduction in borer attack in some localities resulted.

Froghopper (*Aeneolamia varia*) is regarded as next in importance to *Diatraea* among insect pests of sugar cane in Venezuela, where it has been a matter of concern to cane growers for at least half a centry. A paper (*Boletín* 67, by P. GUAGLIUMI) of some twenty pages is devoted to it. The ecology of the insect is discussed and the best means of combating it, including insect predators. The last chapter of this series (*Boletín* 68, also by P. GUAGLIUMI) deals with the minor sugar cane pests of Venezuela.

F. N. H.

Direct evidence for translocation of sucrose in sugar cane leaves and stems. M. D. HATCH and K. T. GLASZIOU. *Plant Physiology*, 1964, **39**, 180–184.—This work was carried out at the David North Plant Research Centre, Indooroopilly, Queensland. By supplying sucrose labelled only in the fructose moeity to leaves, then examining the distribution of radioactivity in translocated compounds, conclusive evidence was obtained that the sucrose molecule remains intact during translocation through the vascular tissue of the leaf, sheath and stem of the sugar cane plant. The translocation velocity for photosynthate and supplied sugars was between 4 and 6 cm/minute.

* * *

Queensland's fertilizer industry. ANON. *Producers' Review*, 1964, **54**, (2), 35.—Reference is made to the proposed fertilizer factory on the Brisbane river for the manufacture of nitrogenous fertilizers, including ammonium sulphate. This is good news for Queensland cane farmers who have had to rely upon supplies imported from elsewhere. These have sometimes been somewhat erratic in the past.

* * *

Spray drift damage. G. W. GAYFORD. *Producers' Review*, 1964, **54**, (2), 63.—Selective weed killers of the hormone type, notably 2,4-D and 2,4,5-T, have proved to be of great value in the destruction of weeds, but care in their use is necessary. The precautions necessary to prevent spray drift damage to other plants are outlined in some detail. The dangers to susceptible crops are far greater when spraying is done from the air.

Soldier fly control on Bundaberg farms. ANON. *Producers' Review*, 1964, **54**, (2), 65.—Reference is made to trouble with this pest, through faulty treatment, and recommendations (by the Director of Sugar Experiment Stations, Queensland) are given for its control. A preplanting broadcast dressing of 20% crude BHC dust at the rate of 308 lb per acre (or 154 lb of 40% crude BHC dust) is advised.

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Comparison of hot-water and hot-air treatments of sugar cane for control of ratoon stunting disease in Louisiana. N. ZUMMO. *Sugar Bull.*, 1964, **42**, 134–136. Three varieties of cane, in one-ton bundles, were used in the tests. Hot-air treatment gave essentially the same degree of control as hot-water treatment. Advantages of hot-air treatment in Louisiana are the low initial cost of the unit and a readily available source of heat, electricity being available on all cane farms.

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Sugar cane borer infestation and loss in Louisiana. L. J. CHARPENTIER *et al. Sugar Bull.*, 1964, **42**, 144–146.—The winters of 1961–62 and 1962–63 were the coldest in Louisiana since the 1890's. Low temperatures, notably 18°F and below, have a marked effect on the survival rate of the sugar cane borer (*Diatraea saccharalis*). Cane trash left in the fields during harvesting to determine the effect of severe temperatures on overwintering borer populations showed a 98% mortality for the winter of 1961–62 and 96% for 1962–63. Borer counts for the different parishes for the years 1959–1963 are given.

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The toll of the tractor. ANON. *Australian Sugar J.*, 1963, **55**, 487.—Attention is drawn to the fact that despite repeated warnings and extensive publicity the number of fatal tractor accidents in Queensland is not diminishing, last year's number being twelve. The number of other, non-fatal, tractor accidents is very much greater. Most serious accidents are due to human error or inexperience. An analysis of the causes of fatal tractor accidents in Queensland is given.

* * *

Planning a sugar beet industry for New Zealand. ANON. *Australian Sugar J.*, 1963, **55**, 507.—Trials with sugar beet were first held in New Zealand in 1880 and on several occasions since, but failed to be of commercial interest because of high labour costs. With monogerm seed, which reduces thinning costs, and with modern mechanical sowers and harvesters the situation has completely altered with regard to manual labour. The optimistic views of a sugar beet expert, recently in New Zealand, are outlined.

Inter-cropping in cane fields now standard practice in Taiwan. ANON. *Australian Sugar J.*, 1963, **55**, 515–516.—This information has been extracted from the remarks of a Taiwan authority on sugar cane (Dr. K. C. LIU). In general there are two systems of intercropping in Taiwan where land for crops is at a premium. In the paddy fields cane is planted about two months before the rice is harvested. In the uplands cane is planted first and followed by the planting of other crops, such as sweet potatoes, peanuts, soyabeans, cotton or maize, planted between the rows of cane.

* * *

Mechanical harvesting hazard. ANON. *Australian Sugar J.*, 1963, **55**, 499.—The case is recorded of a mechanical harvester operator being electrocuted through the elevator of the machine coming into contact with a 10,000-volt high-tension power cable. In view of the height of some cane harvesting machines farmers are urged to make sure similar accidents cannot occur on their properties.

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Sugar cane varieties in Martinique. M. DE POMPIGNAN and E. GRIGNON. *Centre Technique de la Canne et du Sucre de la Martinique, Résultats* 1963, *Variétés*, 112 pp.—Rainfall and weather conditions during the period are discussed as are the main soil types in cane growing areas on the island. A detailed account of variety trials then follows, most varieties being of Barbados origin.

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The expanding world fertilizer market. F. W. PARKER, D. D. STEWARD and P. PEPERZAK. *Fertilizer News*, 1964, **9**, (3), 7–16.—World fertilizer consumption has increased greatly in recent years although there is great disparity between different countries. Estimates on probable future world consumption are made. It is considered consumption figures will have approximately doubled by 1970 and trebled by 1980.

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The fecundity and fertility of Trinidad sugar cane froghopper. D. W. FEWKES. *Trop. Agric.* (Trinidad), 1964, **41**, 165–168.—The writer states that up to now no serious attempts have been made to estimate the fecundity and fertility of this froghopper (*Aeneolamia varia saccharina*). He concluded that the fecundity (egg production) during the dry season was estimated at 10 to 15 eggs and the fertility (number of live births) at 9 to 14 eggs per female per day. Individual dry season females lived in captivity for one to 25 days and laid nil to 294 eggs. Females may require to mate more than once to achieve maximum fertility.

Sucrose formation and concentration in sugar cane. J. L. DU TOIT. *S. African Sugar Assoc. Exp. Sta. Bull.*, 1958, (6), 5 pp.—All the factors that may influence sucrose content in Natal cane fields, including defoliation by locusts, are discussed.

* * *

The production of new sugar cane varieties for Natal. A. MCMARTIN. *S. African Sugar Assoc. Exp. Sta. Bull.*, 1958, (7), 14 pp.—This is a review of past and present work with suggestions for the future. The early history of cane varieties in Natal is dealt with and all aspects of the modern breeding programme now applied.

* * *

Sugar cane pests in South Africa. J. DICK. *S. African Sugar Assoc. Exp. Sta. Bull.*, 1958, (8), 6 pp.—The writer considers South African cane growers fortunate in that their crop is relatively free from severe infestation by insect pests as is the case in many other sugar producing countries. The more important insect pests of sugar cane in South Africa are here described.

* * *

The diseases of sugar cane in Natal. G. M. THOMSON. *S. African Sugar Assoc. Exp. Sta. Bull.*, 1958, (9), 11 pp.—This bulletin is based on a series of lectures delivered to various groups of cane growers. The more important diseases in South Africa are described. Varietal resistance and possible means of control are discussed.

* * *

The development of sugar cane breeding in South Africa and its results. P. G. C. BRETT. *S. African Sugar Assoc. Exp. Sta. Bull.*, 1959, (10), 6 pp.—The history of sugar cane breeding work in Natal is outlined. It started in the 1940's with the discovery that pollen fertility with sugar cane in Natal could be ensured by eliminating low night temperature by the use of a temperature-controlled, electrically heated greenhouse. Present methods and breeding techniques in Natal are discussed.

* * *

Liming in the sugar industry. J. L. DU TOIT, B. E. BEATER and T. A. F. SEXTON. *S. African Sugar Assoc. Exp. Sta. Bull.*, 1960, (11), 3 pp.—With the extensive use of ammonium sulphate as a nitrogenous fertilizer in Natal cane fields the need for liming becomes more apparent. If the pH is allowed to fall too low substances such as manganese and aluminium become soluble and may prove toxic or adversely affect the growth of the cane.

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Trashing. J. WILSON. *S. African Sugar Assoc. Exp. Sta. Bull.*, 1960, (12), 4 pp.—The advantages and disadvantages of trashing, for many years a highly controversial subject, are clearly set out, particularly as they are affected by conditions in the Natal cane belt.

A guide to the use of fertilizers. J. WILSON. *S. African Sugar Assoc. Exp. Sta. Bull.*, 1960, (13), 3 pp.—General advice on the use of nitrogenous, phosphatic and potassic fertilizers in Natal cane fields, with figures for the usual rates of application, are given.

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Supplementary irrigation. G. D. THOMPSON and D. F. COLLINGS. *S. African Sugar Assoc. Exp. Sta. Bull.*, 1963, (17), 13 pp.—Owing to inadequacy of rainfall in the Natal sugar belt, crops produced are seldom the maximum that the climate would otherwise permit. This bulletin has been prepared specifically to advise the Natal cane farmer who wishes to carry out supplementary irrigation. The average response is considered to be an increase in yield of about 12 tons of cane per acre.

* * *

Numicia. ANON. *S. African Sugar Assoc. Exp. Sta. Bull.*, 1964, (15 revised), 3 pp.—The green leaf-sucker of sugar cane, *Numicia viridis* Muir, is a new insect pest, its importance having first become apparent in South Africa in 1962. Populations may build up on grasses surrounding cane. Details of the pest are given. Four colour photographs, to facilitate recognition, are included.

* * *

Mechanization of sugar beet cultivation in Belgium and its problems. M. MARTENS. *Sucr. Belge*, 1963, **83**, 145–152.—Figures are given for the three seasons 1961, 1962, and 1963 which show the rapid advance that has taken place in the use of monogerm seed, the use of chemical weedkillers and mechanical thinning.

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Dynamics of phosphate nutrition of sugar beet. P. LECAT. *Compt. Rend. Hebd. Séances Acad. Agric. France*, 1961, **47**, (4), 197–201; through *Biol. Abs.*, 1964, **45**, 2442.—This is a study of the proper placement of fertilizers by the method of tagged ammonium phosphate. Experiments were effected to determine the absorption of phosphorus and its migration to the leaves of the plant. It was concluded the best place for the phosphatic fertilizer was that location which lies most nearly horizontal in relation to the seed bed, and at such a minimum depth as will permit it to be in humid soil.

* * *

Influence of foliar applied nitrogen on the nutrient content of leaf and leaf sheath, yield and quality of sugar cane. S. KANNAN and V. RANGANATHAN. *Madras Agric. J.*, 1963, **50**, 248–250.—An account is given of various experiments involving ammonium sulphate and urea applied to the soil and as a foliar spray, leaf and leaf-sheath analyses being subsequently carried out. Combined soil and foliar sprays of area gave the highest increases in K_2O. No significant differences in yields were observed between treatments. Brix was as satisfactory with foliar treatments as

with soil applications, and juice purity and C.C.S. were better.

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Increased sugar cane cultivation in Southern Rhodesia. ANON. *Bull. Min. Agric. Fisheries and Food*, 1964, **8,** 35.—Legislation to control the fast growing sugar industry is likely, providing for registration of sugar mills and of growers supplying the mills. It is expected that by 1965 some 220,000 tons of sugar may be produced, about 150,000 tons of which may be available for export.

* * *

The physiology of sugar cane. V. Kinetics of sugar accumulation. R. L. BIELESKI. *Austr. J. Biolog. Sci.*, 1962, **15,** 429–444; through *Hort. Abs.*, 1964, **34,** (1), 196.—Radio-isotope techniques were used to study kinetics of sucrose, glucose and fructose accumulation in slices of immature sugar cane tissue.

* * *

Starch in sugar cane. ANON. *S. African Sugar Assoc. Exp. Sta. Rpt. for* 1962–1963, p. 21.—The nodes of the mature sugar cane stalk may contain 3½ to 4 times as much starch as the internodes and the ratio of starch to sucrose is high in the immature portion of the cane stalk. Further investigations during the year revealed that although the concentration of starch is certainly much greater in the nodes than the internodes in the older and mature portion of the cane stalk, the same does not apply to the young immature portion of the stalk. Here the difference is much smaller and the starch concentrations seem to be largely confined to the growth ring, with little or no starch in the actual node as in the wax band,

* * *

Experiments to control white grub in sugar cane. G. T. BURNETT and T. H. LEATHER. *Misc. Rpt. Trop. Pestic. Res. Inst.*, 1963, (405), 8 pp.; through *Hort. Abs.*, 1964, **34,** (1), 195.—This is Part I—A modified placement method for insecticides. Details are given of redesigned equipment for applying insecticides in screening trials against *Cochliotis melolonthoides*.

* * *

Studies in the disease cycle of *Cytospora sacchari*. S. FLORES and I. L. FORBES. *Phytopathology*, 1963, **53,** 875.—Studies on the occurrence of *Cytospora* sheath disease of sugar cane suggest that young plants are readily infected by conidia in the soil. It is not yet known whether the mycelium grows from the setts into the developing shoots.

* * *

Effect of heat treatment of sugar cane for control of ratoon stunting disease (RSD) on spread of mosaic. N. ZUMMO. *Phytopathology*, 1963, **53,** 894.—Mosaic spread more rapidly in the progeny of sugar cane treated in hot air for RSD control than in similar but untreated cane. Field tests showed RSD had no effect on mosaic spread. Heat treated cane germinated earlier and made more rapid growth and thus was exposed to insect vectors for longer than untreated cane.

* * *

Longevity of *Cephalosporium sacchari* **causing wilt disease of sugar cane.** A. GANGULY and J. N. CHAND. *Sci. and Cult.*, 1963, **29,** 347–348; through *Hort. Abs.*, 1964, **34,** (1), 195.—In naturally infected soil and in soils inoculated with infected plant debris and with cultures of the pathogen, the fungus remained viable for 29, 31, and 27 months respectively.

* * *

The movement of soil water. E. C. CHILDS. *Endeavour*, 1964, **23,** (89), 81–84.—A study of the movement of water through soil, considered as analogous to the flow of heat through a conductor, was developed over a century ago, but this only applies to the simplest cases because the hydraulic conductivity of a particular specimen of soil depends in part on its history. The extension of the simple theory to more complex cases is here described, in the laboratory and to the practical study in the field of land drainage and irrigation.

* * *

Effect of boromanganese fertilizer on the sugar content of sugar beet grown in the Chuya valley. M. A. ZORIN. *Mikroelem. Zhivotn. Rast. Akad. Nauk. Kirgiz. S.S.R.*, 1962, (1), 107–119; through *Soils and Fertilizers*, 1964, **17,** 82.—Dusting sugar beet with 50 kg/ha boromanganese fertilizer increased sugar content by 1%. Application of 200 kg/ha to the soil was less effective.

* * *

The control of the sources of virus yellows of sugar beet. C. R. RIBBANDS. *Bull. Ent. Res.*, 1964, **54,** (4), 661–674.—The means whereby the viruses of sugar beet yellows and their predominant vector, *Myzus persicae*, overwinter in Britain are reviewed. *Myzus persicae* overwinters mainly on cultivated secondary food plants that are not associated with the viruses. The viruses overwinter principally in the mangel and sugar beet seed crops, which are the main source of infection the following summer. Mangel clamps may be a minor source. Weeds are unimportant. The likelihood of infected viruses being blown from the Continent by high wind is discussed.

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Sugar cane borers control by *Trichogramma evanescens*. C. L. PU and C. C. LIU. *Acta Ent. Sin.*, 1962, **11,** (4), 409–414; through *Rev. Appl. Ent.*, 1964, **52,** Ser. A., 103.—The use of *Trichogramma evanescens* Westw. to control cane borers in the Chinese Provinces of Kwantung, Kwangsi, and Fukien began in 1959. In fields in which liberations were made egg parasitism ranged from 60 to over 97%. The percentage of "dead-hearts" and bored internodes was considerably reduced compared with uncolonized fields. Suggestions are made for improving the methods of rearing and liberation used.

THE INFLUENCE OF SOME COLOURING SUBSTANCES FROM SUGAR JUICES AND SYRUPS ON THE COLOUR OF SUGAR

by Dr. HELENA ZAORSKA

(Dept. of Sugar and Food Technology, Lodz Institute of Technology)

Paper presented to the 12th Session of C.I.T.S., Paris, 1963.

PART II

A series of sugar crystallizations was also carried out with refined sugar solutions to which had been added colouring substances obtained by the method described above. The extinction of the sucrose solutions coloured in this manner is given in Fig. 4. The sugar crystallized from the prepared solutions adsorbed the corresponding amounts of colouring substances during crystallization (Fig. 7).

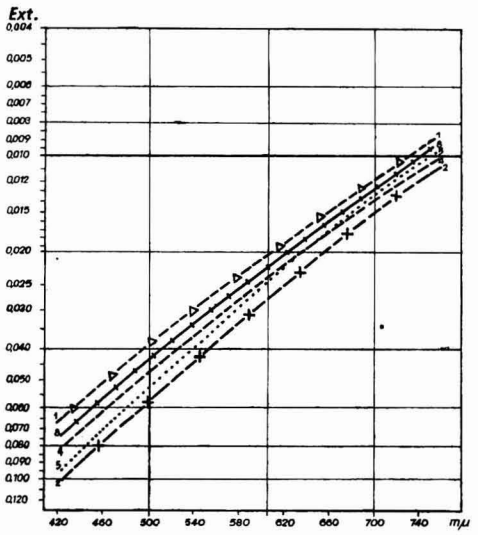


Fig. 7. Specific extinction of sugars crystallized from syrup with colouring matter added.

1. Normal thick juice. 2. Caramelized thick juice. 4. Remelt liquor decolorized with active carbon. 5. Remelt liquor decolorized with resin. 8. Molasses decolorized with active carbon using the column method.

On the basis of the results obtained it is established that during sucrose crystallization the most easily adsorbed colouring substances were those obtained from the remelt liquor and from the partially caramelized juice. The colouring substances contained in the molasses appeared to be somewhat less harmful. The least absorbed were those colouring substances from thick, freshly-obtained juices from healthy beet, as these juices are relatively weakly coloured (a small amount of caramel). It was also established that the colouring substances separated with decolorizing resin have something of a brownish-yellow tint whereas in the case of colouring substances obtained with active carbon the tint is bluish-green.

As the sucrose crystallization proceeds for a definite time and the solutions from which sucrose crystallizes are at an elevated temperature, a certain amount of colouring matter is formed during crystallization. In Fig. 8 the vertical axis shows the %

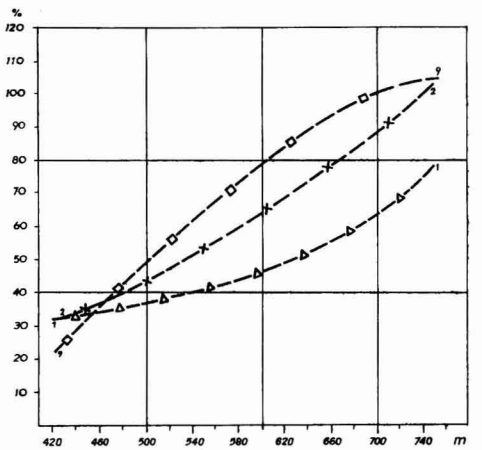


Fig. 8. Rise in extinction of sugar solutions during thickening-up and crystallization. 1. Normal thick juice. 2. Caramelized thick juice. 9. Decolorized thick juice.

increase in the extinction of the solution during heavying-up and crystallization while the horizontal axis shows the light wavelengths. As the graph shows, the value of the specific extinction of the crystallized sugar is not only affected by the presence of the colouring substances introduced into the solution but also by the formation of new colouring substances during the crystallization process. From the studies conducted up to now it may be accepted that during sucrose crystallization with lower coloration the proportion of colouring matter adsorbed from the growing sucrose crystals is less favourable than during sucrose crystallization from darker solutions.

This means that in brighter solutions a greater part of the colouring matter is adsorbed from the sucrose crystal. This is shown clearly in Fig. 9. The vertical axis shows % ratio of the specific extinction of crystallized sucrose to the extinction of the treated mother liquor. The horizontal axis shows the light wavelengths.

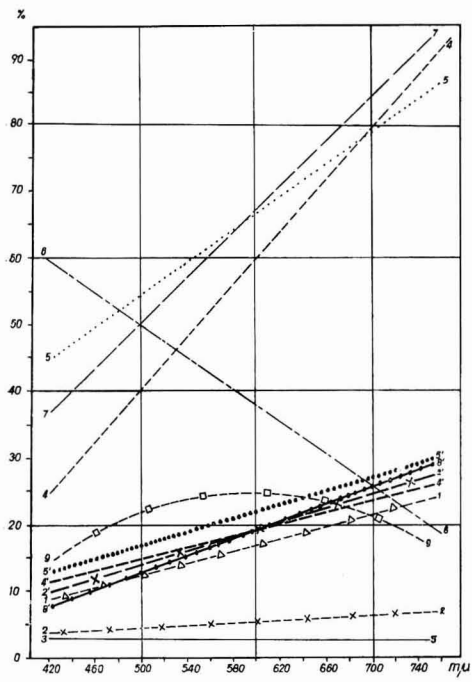


Fig. 9. Percentage ratio of extinction of crystallized sugar to the extinction of the solution subjected to crystallization.

1. Normal thick juice. 2. Caramelized thick juice. 3. Remelt liquor. 4. Remelt liquor decolorized with active carbon. 5. Remelt liquor decolorized with resin. 6. Remelt liquor decolorized by the combined method. 7. Remelt liquor decolorized with active carbon using the column method. 9. Decolorized thick juice.

Sugar crystallized from syrup with colouring matter added: 2′. Caramelized thick juice. 4′. Remelt liquor decolorized with active carbon. 5′. Remelt liquor decolorized with resin. 8′ Molasses decolorized with active carbon using the column method.

On the basis of the tests, results of which are shown graphically, it is established that differences in the adsorption capacity of the sucrose for the individual colouring compounds from syrups and sugar juices are relatively small.

Adsorption of colouring matter on the sucrose crystals is a complex problem. The difficulty lies not only in the fact that new colouring matter is formed during crystallization but also in the fact that during separation from the solution just as much further colouring matter can form. Because of this, it has not been possible to draw a balance between the colouring matter contained in the solution, that removed, that adsorbed during crystallization and that remaining in the mother liquor.

The graph in Fig. 9, which depicts the extinction of the crystallized sucrose as a percentage of the extinction of the solution subjected to crystallization, shows that the colouring substances most readily adsorbed by the sucrose are those obtained with decolorizing resin. Somewhat less readily adsorbed are those colouring substances obtained from remelt liquors and caramelized juice with active carbon. The least readily adsorbed by the sucrose are those contained in the molasses.

At higher extinction of the solution the percentage of colouring matter in the sugar becomes smaller and smaller. Higher amounts of colouring matter were found in sucrose crystals from bright, decolorized solutions. It seems that this cannot be so much attributed to the colouring substances already present as to those formed during crystallization. It was established that the yellow colouring substances are less readily adsorbed than those of an amethyst colour. An exception to this is the crystallization of sugar from solutions decolorized with the combined method. The sugar crystallized from these solutions had the smallest adsorbed quantity of amethyst-coloured substances in relation to the other colouring substances contained in the solution.

Summary

Methods were developed for extraction of colouring substances from sugar juices and syrups using active carbon and decolorizing resins. The colouring substances were desorbed from the active carbon with an azeotropic mixture of water and pyridine and from resins with concentrated ammonium carbonate solutions.

All crystallization processes were conducted under the same conditions at 1·1 supersaturation. The sugar was separated from the mother liquor by centrifuging at 2900 r.p.m.

Thick juice, remelt liquor from the intermediate produce and molasses were decolorized. Using the colouring substances isolated, aqueous sucrose solutions were made up of the same coloration. After thickening-up the solutions were subjected to crystallization. In the same way sugar was crystallized from the decolorized sugar solutions.

The specific extinction of the sugar obtained was studied at different light wavelengths. From this was determined the adsorptive capacity of various colouring substances contained in the juices and syrups. The results were expressed in graph form.

It was established that the largest amounts of colouring substances harmful to white sugar are those contained in remelt liquor and caramelized juices. Somewhat smaller quantities of harmful colouring substances were found in bright thick juices obtained from healthy beet.

SUCROSE CRYSTALLIZATION

By HAROLD E. C. POWERS

Introduction

THE term "crystal" implies an aggregate of like molecules in orderly placement, each with respect to its neighbours. To understand crystallization we need to study the manner in which the molecules behave in this act of aggregation—what we may think of as the "mass psychology" of the sucrose molecule, as it were.

In an earlier article in this Journal[1], I described how sucrose crystallizes in the most fantastic forms, under suitable conditions. Though so unfamiliar to the industrialist, their practical significance was indicated, as was the probability of such forms occurring during the drying and the slow "maturing" of granulated sugars. The sugar boiler may perhaps be forgiven for having felt that his compact multi-sided crystals provided a much less complex aspect of "mass psychology" and that this subject would offer much less challenge to the investigator than many other crystalline materials. Recent studies on these apparently more normal forms have, however, revealed new surprises, particularly those concerning nucleation and early growth.

The sugar industries strive to produce uniform-sized, compact monocrystals yet in practice the product is generally irregular, and sometimes distressingly so. It has been the commonly held view that the presence of certain impurities was the sole cause of abnormal-shaped grain and that all crystals in one system would grow at the same rate. The picture is, however, much more complicated although capable of resolution. As an example, conditions of nucleation and growth may also exert a controlling influence on crystal habit and nature.

Saturation equilibria complications—Differential solubility

The widespread use of the terms "saturated" and "supersaturated", taken in conjunction with the numerous published tables of solubility equilibria at various temperatures, would tend to imply that solubility at saturation is a known and clearly understood condition. This may be misleading, and is regrettable, unless the limitations are clearly understood by all. Nowhere is this more evident than in the study of nucleation and hence in pan boiling.

If we could obtain a sample of sucrose of uniform particle size, of the order of 10 millimicrons diameter, and saturate a sucrose solution with respect to this sample. the resulting concentration would be appreciably higher than the accepted tables indicate. The precise magnitude of the increase is not known but from circumstantial evidence I think it may well be as much as six or even eight per cent higher solids at this level of subdivision. As the particle size is increased so the saturation concentration falls. The solubility curve appears to level off (i.e. the solubility approaches a constant value) for all particle sizes above about ten microns in diameter, and it is the solubility of these grosser particles which is implied in all accepted tables[2].

Attempts have been made to demonstrate and measure this effect, using finely pulverized sugar and "saturated solution." Slight increases may be indicated by refractive index changes, but the effect is transitory since, as the finest particles dissolve, the solution becomes supersaturated with regard to the coarse particles which then grow. VANHOOK and KILMARTIN were more successful, using extremely fine crystals precipitated by alcohol, achieving a transitory gain 4·3% above accepted saturation concentration.

Let us consider the basic reason for this differential solubility. The molecules in a crystal—or for that matter in a drop of rain or similarly suspended fluid—are held together by natural forces of attraction; otherwise their inherent movement and the continual bombardment by surrounding molecules would soon lead to a complete dispersion of the component molecules into the surrounding solution or gas. According to the condition of the system, the molecules tend toward a balance. Surrounding molecules may join the aggregate (i.e. crystal growth) or they may leave (crystal dissolution). Or these migrations may be equal, under which conditions the solution is said to be saturated with respect to the crystals. In the case of suspended raindrops the phenomena would be referred to as condensation and evaporation, respectively.

It will be evident that the smaller the number of molecules comprising the nucleus or seed crystal, the less will be their ability to retain their component molecules and hence their tendency to dissolve or disperse under conditions in which larger crystals or drops would be in equilibrium or even growing. In other words, the smaller the crystal, the more concentrated will the saturation equilibrium have to be.

Dynamic nucleation

Almost invariably nucleation is brought about by adequate movement of crystals relative to the surrounding solution. As was demonstrated in my "fluid wind tunnel" experiments[3], under these circum-

[1] *I.S.J.*, 1960, **62**, 307–312.

[2] The most precise definition of "equilibrium solubility" known to the author is that received in a private communication from N. N. SHEFTAL and dated 10th August 1959, viz.: "The solubility of an infinitely large crystal which exists in a state of equilibrium with the solution, when the deposition and dissolution of particles on the surface of the crystal during the so-called "repeated step" can take place with an equal degree of probability."

[3] *Paper presented to the Divn. of Carbohydrate Chemistry, Amer. Chem. Soc.*, Sept. 1958; *Industrial Chemist*, 1963, **39**, 351–355.

stances, vast numbers of molecular aggregates are shorn from the crystal surfaces. These may vary in size from a few molecules only, loosely bonded together as nuclei precursors (to adopt KUKHARENKO's excellent term), upwards to relatively large "false grain" which had been loosely adhering to the surface of the main grain.

From what has been recorded above it will be seen that the survival and growth of the finer aggregates will depend on the degree of supersaturation of the surrounding solution. If this is about 1·1 S.S., the vast majority will be dissolved, while at 1·3 S.S. only the finest will be dissolved. Quite evidently, but for the saving grace of this differential solubility we should never have succeeded in boiling reasonable crops of sugar as in our present-day pans! Continual blinding with false grain would become almost uncontrollable. Since the speed of dissolution of micro-crystals is so much more rapid than that of larger crystals, even a short exposure to lower concentration may eliminate them with negligible effect, if any, upon the larger crystal.

Microscopic observation

In earler reports[1,4], techniques were described for producing films of sucrose solution at all degrees of supersaturation, even up to the glassy state. So long as the films were not disturbed mechanically, spontaneous nucleation was so rare an event that thin films of the order of up to 100μ in thickness could be brought to equilibrium with low relative humidity atmospheres with the production of only a few nuclei, if any, within the area of the slide used.

Recently operating at a location far from the refinery, I have successfully evaporated solutions to the glassy state in a cell 15 mm deep; this emphasizes on the one hand the difficulty of completely eliminating air-borne nuclei, even with the utmost care, and on the other hand how difficult it is for Nature unaided to bring about the creation of a true sucrose crystal nucleus. Air-borne potential nuclei may be of only one-thousandth of the diameter of a micro-organism and yet provide the necessary pattern for crystal development.

When spontaneous nucleation occurs in undisturbed sucrose solution of over 2·5 S.S. almost invariably spherulitic monocrystals develop. When nucleation is induced by movement within the solution, either of pre-existing sucrose crystals or of any neutral solid body, then monocrystals result *at all supersaturations*. Again the degree of supersaturation exerts a considerable degree of influence upon the type of crystal so produced. From what has been recorded above regarding differential solubility, nucleation brought about in solutions at low supersaturation should result in an apparent succession of crystals developing—and this is just what is seen under the microscope!

A film of solution, at say 1·1 S.S. on a basis of the accepted tables, is prepared on a 3 ×1 inch glass slide and, using forceps, a crystal is moved through the solution. A cover slip is placed on the solution and the slide examined under the microscope. Usually nothing is visible at first, or there may be small fragments which, having been loosely attached to the crystal, have broken away in the solution. Then, as the slide is continuously scanned, a number of fine pinpoints of crystal become visible, along the path of the initial crystal. If the movement has been too vigorous these will be so numerous as to blind the slide with a veritable galaxy of crystals which overgrow one another in a formless mass.

A suitably less vigorous movement will result in a more open dispersion in which the observer may follow the growth of individual crystals. It will then be seen that whilst many remain as scarcely visible points, others develop with increasing speed as they become larger. In time even the pinpoints develop along the same pathway of accelerating growth, as do others not visible at all initially. We now know that almost inevitably vast numbers of aggregates were too small either to be seen under the microscope or to grow in the 1·1 S.S. solution, whilst others, borderline in size and hence solubility, must be hovering at equilibrium with the solution.

Some degree of uniformity in growth rate of different crystals of similar size is evident, but this is by no means universal. Here and there one will be seen to exhibit a strong surge in rate of growth, sometimes mainly upon certain faces of the crystal. This is not surprising in view of what we now know about the variety of surface growth mechanisms. Some surfaces may be relatively free from molecule-gathering imperfections, and therefore hardly grow at all, whilst others may develop most efficient surface imperfections (faults) and be able to grow at a greatly enhanced rate. It remains to be seen whether it will prove possible for us so to influence these surface mechanisms as to facilitate the rapid and economic production of sugar of crystal form or habit best suited to our needs. We need much more evidence upon surface growth mechanisms and their operational causes. We need to study the abnormal at least as much as the normal, just as does the botanist or biologist seeking to improve the strain.

Observations at 1·3 *to* 1·5 *S.S.*

If the above experiments are repeated using solutions of 1·3–1·5 S.S. instead of 1·1 S.S., nucleation is naturally induced more readily and growth is more rapid, but again some crystals develop early rapid growth whilst others are retarded by their smaller size and hence differential solubility. There is still a wide variation in size of the crystals developing from the one nucleation incidence but a higher proportion are included in the early growers.

If observation is continued for twenty or thirty hours a new phenomenon is revealed. A "generation of late developers" will be observed, mainly acicular

[4] POWERS: *J. Royal Microscop. Soc.*, 1963, **82**, 23–28.

or needle-shaped, sometimes accompanied by a small proportion of regular square-contour crystals (Figs. 1, 2). Sometimes these needles may be so fine as to resemble "whiskers", to use the term in a crystallographic sense, and sometimes the axis ratio is merely increased to say 10:1 (Fig. 3). If a 3×1 slide with a sunk well be used to provide greater depth of fluid, then these late developers may be left suspended whilst the more normal earlier and much larger crystals have settled out. This is easily seen by differential focusing.

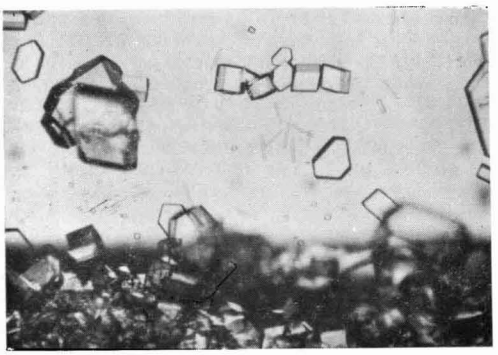


Fig. 1. Abnormal forms resulting from "late developers" in 1·4 S.S. solution

The phenomenon may be demonstrated even more strikingly if the experiment is carried out in a tall glass tube[3]. In this case a crystal must be moved momentarily in the top inch of solution, fairly vigorously, to ensure plentiful nucleation. In the following hours the resulting crystals are seen subsiding like snowflakes in the tube. After a day or so those crystals remaining near the top may be recognized as needle-like. In one such experiment two weeks elapsed before most of the earlier normal crystals had subsided and by that time the needles had spread down through the upper 3 feet of tube.

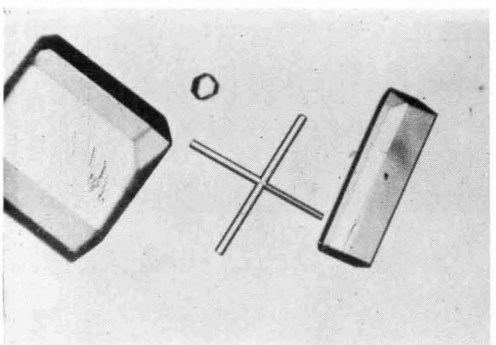


Fig. 2. Acicular to square contour crystals. Note the irregularity whereby only 3 of the 4 arms of the "fused" two needles have started thickening.

Acicular or needle crystals

It is interesting to reflect that only a few years ago it was felt in the industry that needle grain was solely due to the presence of certain impurities which, being adsorbed on certain faces of the crystal, blanked off further growth and led to the needle distortion. Such an explanation does not easily account for the phenomenon just described and I believe it is much more likely that it is due to the different mechanism of growth set in operation at nucleation. Since growth is so slow, it is unlikely to be attractive industrially but "needle grain" remains an interesting extreme example of the variation in rate of growth and in form, possible in the same solution as more normal grain. When it occurs naturally, as it does in some localities, it is regarded as a nuisance.

From present evidence, I believe that many of the abnormal forms now well known to occur in the industry owe their existence to two factors: the presence of certain impurities, and the practical circumstances of nucleation and growth. It should be possibie to test the relative importance of these two influences by dissolving some of the massecuite, evaporating to known supersaturation, nucleating dynamically under standard or near-standard conditions, and watching to see what type of grain develops.

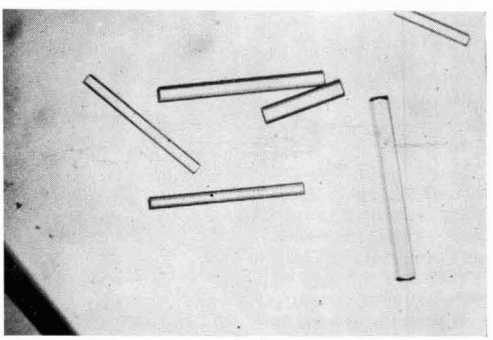


Fig. 3

If the industrialist desires rapid crystal growth in the pan it would appear that the most suitable type would be that with rapid growth in all faces, i.e. an axis ratio of 1:1:1, rather than the acicular type which grows slowly on some faces, i.e. the largest. Also, weight for weight, the acicular form will have by far the highest syrup-retaining surface area. In favour of the acicular form, however, one might expect it to dissolve more rapidly than the 1:1:1 type.

Observations at 2·5 S.S. and above

If, in the case of dynamic nucleation of a sucrose solution which has been evaporated to 2·5 S.S. or above by "humidator", the applied movement of the crystal is too rapid, such prolific nuclei production occurs that the individuals are quickly obscured in the mass. With care, however, a suitable dispersion may be achieved, permitting observations of the

protracted growth and in their regular square contour. One is led to speculate upon a common origin, all the crystals having the same nucleation mechanism, and regular growth being maintained by the absence of effective solubility differential and by uniformity of growth mechanism. By creating a second nucleation incident when the first generation are seen to be already well-developed, a second generation of again regular crystals may be formed, as illustrated in Fig. 4.

"*Sleeve of exhaustion*"

Probably the main difference between growth in stirred as distinct from unstirred solutions, is directly traceable to disturbance in the "sleeve of exhaustion". This zone between crystal and the main body of solution is vastly important and has received but little critical examination in the past from within the sugar industry. Private correspondence with research

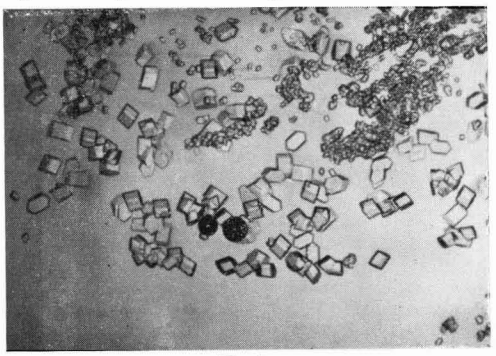


Fig. 4

workers in the plastics and polymer field indicates that they are also coming to the same opinion, although they naturally look upon it in a different light, calling it the "zone of mounting impurity". We in the sugar industry tend not to regard water as the major impurity in a sugar solution although it is so, on a percentage basis.

As sugar molecules leave the solution to attach themselves to the crystal face, a complex diffusion process is brought into play. The concentration of impurities in this surface film is increased and the component molecules therefore tend to diffuse away as crystallization proceeds, sucrose molecules at the same time diffusing into this zone. The rate of diffusion is proportional to the molecular weight of the molecule. Hence water, a relatively light molecule, diffuses away more rapidly than larger and more complex molecules—hence the well-known fact that the more complex molecules exert increasingly marked effects upon the rate of crystallization.

Stirring will obviously decrease the thickness of this sleeve of exhaustion but it is unlikely that it will ever be eliminated in the relatively slow motions most frequently encountered in industrial operations. Hence stirring may be expected only to moderate the effects noted in the unstirred solutions.

The presence of the sleeve of exhaustion may readily be seen, even with the unaided eye, if a crystal of fairly large size—1 cm or longer—is permitted to grow whilst suspended in a solution of about 1·3 S.S. in a vertical glass cell. The slightly exhausted solution having a lower density and rendered visible by the difference in refractive index, rises from the crystal like smoke from a chimney.

Evidence of the significant effect of this may also be seen by observing the effect upon micro-crystals entering the zone of lower concentration around a large crystal. If this takes place in a system at low supersaturation the micro-crystal may dissolve away to the higher solubility corresponding to its smaller size. If it takes place in a system of very high supersaturation it may grow rapidly, since rate of growth rises with supersaturation up to 2·5 S.S. and thereafter falls off. I have been able to record examples of both these phenomena by time-lapse cinemicrography.

It will readily be seen that the effect of stirring upon the sleeves of exhaustion will be of real practical significance, particularly when studying the density of grain population in pan boiling. At what density do the sleeves of exhaustion materially overlap? How will this affect the phenomena of further nucleation and growth?

Still another effect is of interest. The presence of the sleeve is manifestly an indication that sucrose molecule deposition, i.e. crystal growth, is proceeding more rapidly than the impurities are able to diffuse away. It is possible to imagine two crystals growing near each other, one rapidly and being surrounded with an evident sleeve, and the other growing so slowly that practically no sleeve can be seen. I have been able to record this also by both photomicrography and by time-lapse cine-micrography, the crystals being two different types of spherulites. (Fig. 5).

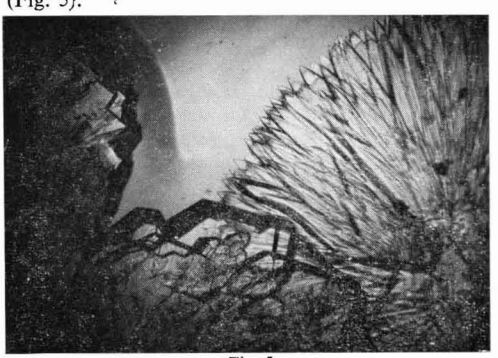


Fig. 5

The "spear-pointed" variety have perfect sides and were growing very slowly in a solution of well over 4 S.S., whilst the flat-fronted type arose from later deliberate nucleation, probably full of faults and growing rapidly all over their surfaces. This was accentuated by the dilution in the sleeve where supersaturation was falling towards the optimum for rate of growth, i.e. about 2·5 S.S.

MECHANISED SUGAR CANE PRODUCTION CONFERENCE

DURING the 10th–13th August there was convened at Stoneleigh in Warwickshire, England, the first Massey-Ferguson conference concerned with mechanized sugar cane production and involving sugar men from several continents. As is natural, a conference organized by a commercial enterprise often has a commercial end and, in this case, one aim was the introduction and demonstration of the Massey-Ferguson 515 cane harvester and the M-F cane cultivation system to those present. But this was subordinated to the development of discussions on the whole subject of mechanization in the cane field by the range of papers presented on facets ranging from planning a cane growing project to cane reception at the sugar factory.

The location of the Conference was the Massey-Ferguson School of Farm Mechanization, a 500-acre site in gently undulating countryside, having a group of single-storey stone buildings where courses of instruction in repair and maintenance, operation, etc. of M-F equipment is provided for between 1000 and 1500 students a year, a quarter of them from overseas. Delegates representing cane growing and sugar producing companies, consulting engineers, equipment manufacturers. etc., as well as the Press, gathered at the School, to which they were welcomed by Capt. D. C. HILL, R.N.(Retd.), General Product Training Manager for the Company. He introduced Mr. J. W. BEITH, Managing Director of Massey-Ferguson (Export) Ltd., who explained the aim of the Conference–"To pool world-wide experience in the techniques of growing and harvesting cane by mechanical means, thereby encouraging the development of methods which will truly reduce costs of sugar production".

Top (left ro right): A. C. BARNES, J. W. BEITH, H. W. KERR, H. A. THOMPSON.
Centre (left to right): T. STORRAR, N. LUCIE-SMITH, L. STENSTROM, D. C. P. EVANS.
Bottom (left to right): C. S. WRIGHT, W. DAVIES, S. W. D. BAXTER, D. W. PARRY.

He quoted labour requirements in various parts of the world for cultivation of cane, ranging from 89 man hours in Puerto Rico to 17 man-hours in Hawaii; the achievement of the lower figure through mechanization is an obviously desirable aim where labour is expensive and/or scarce. Mr. BEITH then introduced the Chairman of the Conference, Mr. A. C. BARNES, C.M.G., the distinguished sugar cane agriculturalist whose career in the industry has occupied many years and been spent in many countries. Mr. BARNES briefly described the development of mechanization of cane cultivation and reviewed the present state of the sugar industry. He explained how it was clear that the future development and continuing prosperity of the cane sugar industry is heavily dependent on the complete mechanization of the work concerned

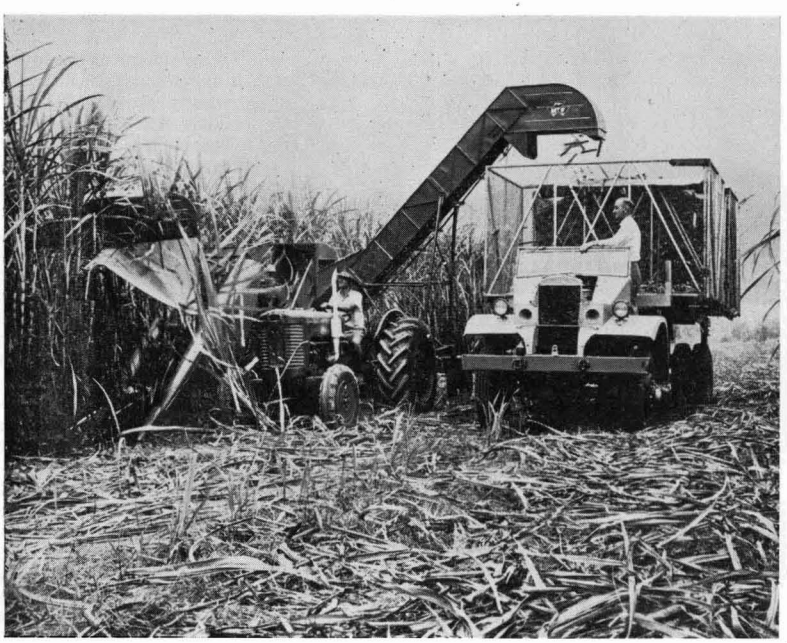
with the production of cane in constantly increasing quantities.

The Chairman then called on Dr. W. DAVIES, Director of the Grassland Research Institute, who presented a paper "A Grasslander's View of the Sugar Cane Crop", in which he discussed aspects of cane cultivation as compared with the smaller members of the *Graminaea* or grass family. He was followed by Dr. R. O. PETERSON of Massey-Ferguson Ltd., Toronto, Canada, who provided in his paper many interesting data on the relative proportion of land devoted to cane—only 20 million acres out of a total of 2400 million acres of arable land and forests for wood production—as well as other matters concerning sugar. He pointed out that there were only one million tractors in operation in the developing countries compared with 10 million in the developed countries; capital investment was required for the spread of mechanization so as to raise production potentials and for sugar cane this amounted to between $2.44 and $4.00 per ton of sugar depending on whether mechanization is complete or only on a limited scale. Criteria for working out investment were, in general, a capital requirement of 50–60% of the annual value of the crop and a requirement of up to 6 times a man's annual wage for his replacement by a machine. (Conditions producing heavy wear in cane machinery might limit this to 4 times). Productivity of the machine was important; and he referred to cane throughput by the M-F 515 harvester as averaging 7/8000 tons per 120-day season, between limits experienced up to 17,000 tons and as low as 5000 tons. The "combine harvester" approach was preferred, with supply of chopped cane to the container delivered to the factory because this avoided double handling and dirt contamination as well as reducing costs. Erect varieties were to be preferred although the machine would handle lodged cane. Dr. PETERSON presented charts detailing profitability factors in cane cultivation, factors related to cane harvesters, and cane transport implications, as well as the problem of trash in cane cultivation.

D. C. P. EVANS, Product Planning Specialist of Massey-Ferguson (Export) Ltd., then presented a paper on the "Deployment of Mechanization in Sugar Cane" in which he discussed the agricultural, sociological and economic aspects of mechanization before passing to farming practice in cane cultivation, the nature of the cane plant, and mechanical operations in its production and handling.

The sprinkler irrigation of sugar cane was next described by C. S. WRIGHT, Chairman and Managing Director of Wright Rain Ltd., the largest producers of sugar irrigation equipment in Europe. He described possible layouts and operation of sprinkler irrigation equipment, as well as the types available and suitable for cane. He concluded with a comparison between surface and sprinkler irrigation, quoting Natal figures which indicate halved costs for water and labour costs reduced to a quarter by use of sprinklers.

S. W. D. BAXTER, Cane Harvester Co-ordinator for Massey-Ferguson, then described the conception, design and performance of the 515 cane harvester both in Australia, where it originated, and in other parts of the world (Fig. 2). His paper was also illustrated by means of slides and a short film. He pointed out that the machine removes the tops and delivers cane in pieces 11–14 inches long which it elevates and delivers to a following or parallel-moving receiving bin-trailer or truck. He showed the machine cutting a lodged and tangled crop of cane of 70 tons per acre where it handled only 8 tons per hour (the hand cane cutters had refused to cut this crop) and also referred to its handling 40 tons per hour in a standing cane of 30 tons/acre. Further information on the machine's application in Africa were given by Mr. D. M. SMITH, who stressed that it would work



under variable conditions but, in order to achieve maximum benefits, should be used in optimum conditions to be allowed for in the cultivation programme, such as using a row width of at least 66 inches, elimination of cross furrows at close intervals for irrigation, and extension of rows (e.g. by running two fields into one), as well as the use of an auxiliary team to cut the tops from fallen cane and to return uncollected cane pieces to the next row.

Mr. T. STORRAR, Director of The Mirrlees Watson Co. Ltd., next presented a paper on factory planning for mechanically harvested cane, pointing out difficulties which had arisen with mechanical harvesting and how cane reception had had to be adapted to meeting these. He illustrated early transport arrangements with donkeys, bullock carts, trucks and railcars, and discussed the benefits and problems which would be raised by provision of cut cane. A suitable means of storage at the factory for overnight use might be a concrete silo, similar to the type used for beet, which would eliminate the tying up of capital in mobile containers which would be held to await unloading.

"Harvesting Methods in Relation to Sugar Production" were discussed by Dr. H. W. KERR, of Queensland, who referred to the advisability of burning the cane trash before harvesting by machine, and the effects so far as sugar manufacture is concerned. He described the milling advantages of chopped cane and aspects of sugar deterioration, which should be minimal if the cane is delivered to the factory within 24 hr of cutting, factory storage is minimized, and the machine is kept clean and well adjusted, with sharp blades.

A Forum devoted to the topic of cane transport was introduced by Mr. D. C. P. EVANS, with contributions from Drs. KERR and PETERSON and Messrs. STORRAR and SMITH as well as delegates. Various suggestions were made as to the best techniques, including the use of small bins filled by the harvester and run direct to the factory where this is only a small distance away, or discharged via a tipping ramp or in-field elevator to a larger container for distances of 5 miles or more. Storage at the factory for 24-hour crushing created difficulties which were discussed, and the varied experiences with night harvesting were discussed; adequate lighting appears to be all-important, and radio-control of operations from the mill to ensure co-ordination of cane supplies was also recommended.

A paper was then presented on the "Development of Sugar Cane Production in Emergent Territories" by M. N. LUCIE-SMITH of Bookers Agricultural Holdings Ltd. He described the factors influencing the decisions of developing countries to introduce sugar industries, often on achievement of independence, and went on to give details of the tremendous amount of work which has to be done in preliminaries to establishment of such an industry and the important stages in its progress. He referred to the equipment and regretted that U.K. manufacturers had no tractors and implements specially designed and suited for cane cultivation; a particular requirement was a high-clearance tractor which was not available from U.K. manufacturers—including Massey-Ferguson.

The sugar producer's approach to mechanization was discussed by H. A. THOMPSON, Agricultural Adviser to the West Indies Sugar Co. Ltd., who provided an impressive account of the varied interrelated factors which must be studied in the development of cultivation, irrigation and drainage techniques adaptable to mechanization and affect the decisions as to the extent and type of mechanization.

Mr. LARS STENSTRÖM, Farm Power and Machinery Specialist for the Agricultural Engineering Branch of the Land and Water Development Division of F.A.O., then gave an account of the rôle of the F.A.O. in sugar-producing areas, particularly the developing countries of the world. The last paper was by Mr. D. W. PARRY of Massey-Ferguson (Export) Ltd., who discussed the responsibilities of the machinery manufacturer in the sugar cane world, and the measures taken by Massey-Ferguson to meet these responsibilities. These include product planning to meet requirements of users and after-sales service—including local representation, spare parts availability and education. In connexion with product planning, his Company had had in mind criticisms—like that of Mr. LUCIE-SMITH—of a lack of machinery designed for cane cultivation and he introduced with a flourish a new "Hi-hi" model tractor which gave a clearance of 33 inches and which was being especially introduced for cane farmers.

The range of M-F cane farming equipment was then put on static display; it included tractors, inter-row cultivation equipment, planting and stubble-shaving machines, and also the M-F 515 cane harvester. In addition were displayed rotary cultivators produced by Howard Rotovator Co. Ltd., spraying equipment by The Dorman Spraying Co. Ltd., and irrigation pipes, sprinklers, valves, etc. provided by Wright Rain Ltd.

Field demonstrations were arranged of this equipment and also ditch digging equipment, ploughs, tillers, loaders, etc., following which the plenary session was held and the Conference closed, except for those visitors who wished to inspect the machinery more closely and to drive and operate it personally.

The Massey-Ferguson Company provided a reception for visitors on the first evening of the Conference when it was possible for them to meet each other, and also invited visitors to an excellent Conference Dinner on the second evening. For those planning to stay to operate the farming equipment alternative arrangements for the third evening were a sight-seeing tour or a visit to the Royal Shakespeare Theatre, Stratford-upon-Avon, for the first night of Richard III in the quatercentenary season.

It will be evident from the foregoing that there was much for visitors to learn from the Conference, both from the papers presented and the discussions which ensued, and it is fortunate that the Company plans to publish a Proceedings in English, German and Spanish. Much credit for its success was due to the Conference Chairman who maintained a firm control which nevertheless provided adequate flexibility to allow free discussion of the papers presented, and Massey-Ferguson are to be congratulated on the venture.

The effect of asymmetric distribution of the mass of a suspended centrifugal on its movement. M. I. BOVDA. *Trudy Kiev. Tekhnol. Inst. Pishch. Prom.*, 1963, **27,** 145–156.—Differential equations describing the movement of an asymmetric centrifugal are reduced to a Hill equation which is solved in the form of squares derived from trigonometric or hyperbolic functions. Thus are obtained the laws of nutational, precessional and rotary movement of the centrifugal. The effect of various factors on the basket movement is discussed and deviations in the angle of nutation shown to be very small.

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Middle juice carbonatation process and its economies. B. B. PAUL and A. K. MITRA. *Indian Sugar*, 1963, **13,** 485–491.—Middle juice carbonatation, in which partly evaporated juice of 35–40°Bx is carbonatated, is compared with the conventional De Haan process. Apart from greater non-sugar removal and lower filter area requirements, the greatest advantages lie in the lower coke and lime consumption since coke is scarce and lime very expensive in India. Disadvantages of the scheme are also discussed. To overcome these, certain changes in the conventional scheme are proposed, including treatment in "Dorr-Clones" before the evaporators and adding phosphate at 100 mg/litre to improve filtrability. The pH of the pre-limed juice was found to be highly significant. While no great differences were found in the mixed juice and 2nd press juice purities, a calculated net gain of Rs. 69,500 per season may be achieved by introducing middle juice carbonatation in a 2000-ton factory.

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More sugar from the High Dam. M. R. BULL. *Sugar y Azúcar*, 1964, **59,** (1), 34–35, 48.—A general picture is given of the Egyptian sugar industry with information gathered by the author during visits to various factories.

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New types of cooling crystallizers. M. ŠKRÁBAL. *Listy Cukr.*, 1964, **80,** 15–17.—Details are given of two new Škoda crystallizers. One is provided with rotary disc-type cooling elements and is particularly suitable for rapid cooling of cube sugar massecuite where a large cooling surface is required. The other type has a rotary cooling spiral, the length of which is divided into three sections. In each section the vertical sections of the tubes which make up the spiral are arranged in rows of four in series in each circumferential section. Water is fed continuously into the central shaft and flows through the tubes in such a way that each tube section is fed before the water is returned to the central shaft and is discharged at the same end as it is fed. The performance of this crystallizer is shown graphically in terms of purity drop in the mother liquor *vs.* time.

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I.S.C.A.S.A. heating element. J. DÍAZ M. *Mem. V Conf. Int. Inst. Técn. Azuc. Veracruzano*, 1961, 236–243.—The element was designed at Ingenio San Cristóbal y Anexas S.A. for reheating massecuite uniformly before delivering to the centrifugals. It consists of a series of 180° disc sectors mounted on a shaft in such a way that each is displaced through an angle of 47° with respect to the next. Each contains an internal baffle with the water inlet on one side and the outlet on the other so that the water flows from one end of the sector to the other and back again before leaving. The exit port of one sector is opposite the inlet port of the next, the port and connecting tube having a streamlined shape so that resistance to turning of the shaft is minimized while the massecuite in the mingler is heated uniformly with a certain amount of stirring. The element contains 56 sectors with a total surface area of 34,650 sq.m. It revolves at 9·5 r.p.m. and passes 30,000 litres/hr (132 g.p.m.), achieving a transmission coefficient of 109 Cal/hr/sq.m./°C while heating massecuite from 34·8° to 50°C, the water being cooled from 67·2° to 64·3°C.

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Methods for the control of third massecuites and operation of the crystallizers. F. N. RAWLINGS and L. C. ROJAS. *Mem. V Conf. Int. Inst. Técn. Azuc. Veracruzano*, 1961, 244–248.—Aspects of low-grade boiling are discussed and the importance of good pan work emphasized since poor work, i.e. uneven grain size, etc., cannot be corrected in the crystallizer, the rate of crystallization in the latter being moreover much lower than that in the pan. The two principal functions to be observed at the crystallizers are to provide the maximum agitation so that the crystal surface takes up sugar as quickly and efficiently as possible and to cool the massecuite in relation to the crystallization of sugar so as to maintain the most effective supersaturation. Care is essential when diluting or reheating the cooled massecuite before purging and this is emphasized.

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I.S.C.A.S.A. mill control. M. ROJAS. *Mem. V Conf. Int. Inst. Técn. Azuc. Veracruzano*, 1961, 249–271.—A detailed description is provided of the automatic cane carrier control at Ingenio San Cristóbal, where cane carrier speed is governed by current overload measurement of cane knives and crusher drives.

Better control in second carbonatation by recirculation. B. B. PAUL. *Proc. 31st Ann. Conv. Sugar Tech. Assoc. India*, 1963, 53–56.—See *I.S.J.*, 1964, **66**, 263.

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Some suggestions for improving evaporator capacity. S. P. SANYAL. *Proc. 31st Ann. Conv. Sugar Tech. Assoc. India*, 1963, 57–60.—While vapour bleeding to juice heaters from the 1st and 2nd effects of a quadruple-effect evaporator will give only a negligible increase in evaporation capacity, using the 1st effect as a pre-evaporator (vapour cell) and the other three effects as a triple-effect evaporator is shown to be more effective. The vapour from the pre-evaporator is bled to the juice heaters and/or vacuum pans. Calculations for a 4 × 2500 sq.ft. h.s. system show that use as a pre-evaporator and triple effect raises evaporation capacity from 50,000 to 73,500 lb/hr, while steam consumption is only slightly higher at 18·6% on cane *vs.* 18·0%.

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Drying of the bagasse in sugar factories. R. L. JONEJA, S. C. SHARMA and H. C. SIKRI. *Proc. 31st Ann. Conv. Sugar Tech. Assoc. India*, 1963, 71–76.—At Saraswati Sugar Mills the moisture of the bagasse going to the boilers was reduced by a further 2·83% (to an average of 45%) by passing it to the top of a drying tower and then allowing it to fall against an upward stream of flue gas blown by a fan at 24,000 cu.ft./min. The effective falling height was nearly 35 ft and the flue gas temperature in the tower was 310–320°F. The resulting monetary savings are calculated.

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Economization of steam consumption in (a) cane sugar factory. II. –. MANMOHAN and B. B. PAUL. *Proc. 31st Ann. Conv. Sugar Tech. Assoc. India*, 1963, 93–97.—At Daurala the total steam consumption was reduced from 59·05% to 56·75% on cane by bleeding vapour from the 2nd effects of the two quadruple-effect evaporators to two vacuum pans and feeding condensate flash to the 3rd effects. When there is a drop in steam requirements and the pressure exceeds 6 p.s.i.g., the excess is automatically fed to the distillery along a separate steam line until the pressure drops. Since the pan boiling time is increased as a result of using lower temperature 2nd effect vapours, the pan capacity or heating surface is to be increased by 15%.

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Study on kinetics and mechanism of first carbonatation in view of continuous first carbonatation. –. MANMOHAN and B. B. PAUL. *Proc. 31st Ann. Conv. Sugar Tech. Assoc. India*, 1963, 167–177.—The four stages in batch carbonatation (heating mixed juice to 55°C, liming to pH 10·5, gassing with CO_2 and maintaining the titratable alkalinity at 400–550 mg/litre) were studied and the data processed using the least squares method to establish the relationships between time and CaO content and time and pH. Graphs for both relationships are presented and it is concluded from the calculations that, by adjusting the quantity of recirculated juice so that a pH in the range 10–12 is attained in 3–6 min, the complete first carbonatation process can be made continuous.

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Some observations on the deterioration of sugar colour in carbonatation factories. II. D. R. PARASHAR and B. BOSE. *Proc. 31st Ann. Conv. Sugar Tech. Assoc. India*, 1963, 179–189.—Examination of bagged sugar stored in godowns showed that reducing the height of the stacks does not reduce colour formation and that the colour deteriorates more rapidly in low godowns. The other indications with regard to sugar deterioration are the same as those given previously[1].

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Effect of the weight of cane trash on the realization of the cane grower. J. K. AHUJA. *Proc. 31st Ann. Conv. Sugar Tech. Assoc. India*, 1963, 191–198.—The effect of the weight of material used for binding cane bundles sold to factories on the amount paid for the cane (a sum of money is deducted from that corresponding to the gross weight of the cane bundle) is evaluated mathematically. To avoid losses or gains made by the grower according to the amount of trash used for binding, it is recommended that the trash rebate be based on the average weight of material gauged from sample determinations and that regional estimates also be made.

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Fuel and steam economy in Indian sugar factories. I. General consideration and target figures. S. C. GUPTA, S. L. SAXENA, S. K. GHOSH and P. N. R. RAO. *Proc. 31st Conv. Sugar Tech. Assoc. India*, 1963, 207–222. **II. Steam consumption.** *idem ibid.*, 235–245. **III. Steam generation.** *idem ibid.*, 247–255.

I. Bagasse moisture can be reduced by improving milling and imbibition (aiming at 47% moisture) and further by installing a return bagasse carrier on which some drying by evaporation would take place. The use of drying by flue gas is not favoured primarily because of fire risk. The requirements for efficient burning of bagasse in furnaces are considered, including feeding, control of excess air feed for combustion, furnace and boiler design and dimensions. Losses in the form of waste gases leaving the furnace at 500–700°F may be reduced by installing economisers and air pre-heaters. Advice is given on the temperature of economiser water fed to the boiler and on flue gas temperature reduction. Calculated heat losses are tabulated. The amount of steam consumed by prime movers and in various processes is considered. It is concluded that by heating raw juice first in vapour line juice heaters and then with vapours bled from the 2nd effect of a quadruple-effect evaporator and by using evaporator vapours for all other heating purposes as well as the pan station, the amount of

[1] *I.S.J.*, 1963, **65**, 240.

steam used to heat and boil the juices and syrups can be reduced by 17% on cane.

II. Means of reducing steam consumption are considered. These include the installation of vapour line juice heaters and the bleeding of evaporator vapours to juice heaters (see above), the replacement of batch settlers and filter-presses with continuous settlers and rotary vacuum filters. While there is a limit to the number of effects in an evaporator, since any improvement in steam economy decreases with each additional effect, the use of vapour cells (pre-evaporators) is advocated, and the steam consumption and evaporation of a quintuple-effect evaporator is compared with that of a quadruple-effect evaporator plus pre-evaporator and of a quadruple-effect evaporator. Means of reducing pan steam consumption are also suggested.

III. The losses in the steam generating plant are considered and the factors affecting the efficiency are discussed. In the design of a bagasse furnace, the various types of which are discussed, the most important factors are (i) bagasse moisture content, (ii) the volatile matter content, and (iii) the properties of the ash. The installation of economisers and/or air pre-heaters to reduce flue gas temperature is discussed and data from various factories are compared. The amount of fuel and money saved by installing economisers of 7000 sq.ft. and of 4200 sq.ft. h.s. is calculated. Other topics covered include the provision of hot feed water, the collection of condensate, the use and maintenance of boiler house instruments and the use of steam accumulators.

* * *

Fully automatic sugar centrifuges increase output and quality. ANON. *S. African Sugar J.*, 1964, **48**, 51.—Automatic control of centrifugals is discussed with a brief description of the Siemens-Schuckertwerke system for charging control. This is very accurate and measures the increase in the moment of inertia by recording the speed pattern during charging; no ancillary equipment is required. Accurate detection of all speed stages with, basically, a voltage measuring relay, is also dealt with. The advantages of automatic control (including supervision of a number of centrifugals by one operator) are discussed.

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Modern electrical charging control for sugar centrifugals. B. AMELUNXEN. *Zeitsch. Zuckerind.*, 1964, **89**, 83–85.—The control device described operates as a function of the basket speed and the increase in its moment of inertia. The speed is measured by a tachometer and charging stops automatically when a required volume of massecuite has been fed.

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Semi-conductor devices and their industrial uses. J. CARLES. *Rev. Agric. Sucr.* (Mauritius), 1963, **42**, 249–262.—The properties of semi-conductors and their general applications are discussed. Of possible interest to the sugar technologist is the section dealing with the possible uses of semi-conductors (in particular silicon controlled rectifiers) for cane mill and centrifugal drives.

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Experimental unit for producing vitaminized refined sugar. Z. V. KOCHETKOVA, S. M. LEKHNO and F. M. POLISHCHUK. *Sakhar. Prom.*, 1964, **38**, 188–190. Details are given of a unit for mixing refined sugar magma with ascorbic acid (vitamin C). The unit consists basically of a hopper feed screw device for the magma, a conical device with a variable distance between the cone bottom and a plate for the discharge of the ascorbic acid, and a paddle-shaft mixer. The mixture is finally pressed into 16 g tablets. No deterioration has been found in the ascorbic acid even after 13 months.

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Use of induction friction clutches in the sugar industry. G. A. KAMINSKII. *Sakhar. Prom.*, 1964, **38**, 191–195. The application of these clutches as regulators for variable-speed drives of sugar plant instead of the conventional generator-drive system which is cumbersome, complicated and expensive, is discussed. The two systems are compared in detail and the mode of operation of the clutch is described.

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Measuring raw juice delivery (in pipelines). A. L. ANTONOVICH. *Sakhar. Prom.*, 1964, **38**, 196–197. Differential manometers used to measure the pressure drop and thus juice delivery in a pipeline may give incorrect readings because of blockage of the draw-off tube. This can be freed by means of periodic blow-throughs. A simple system is described and an equation presented for calculating the correction factor to apply where the pipeline diameter is reduced through scale formation.

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Withdrawing fluids by centrifugals pumps from vessels working under vacuum. I. L. VILYANSKII. *Sakhar. Prom.*, 1964, **38**, 200–202.—The scheme described by SAVCHUK[1] is criticized, and reasons for interruptions in syrup flow from an evaporator and condensate flow from a tank are put forward. A number of suggestions are made whereby stoppages and possible cavitation in the pipeline may be prevented.

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The inverted syphon and its characteristics. A. L. WEBRE. *Sugar y Azúcar*, 1964, **59**, (3), 33–35.—Applications of inverted syphons are noted, particularly for juice transfer between evaporator effects and for condensate transfer betwwen calandrias, and a guide is given to their proper use and installation. The effect of flashing on the discharge side of the syphon is discussed in the light of the author's own experiences.

[1] *I.S.J.*, 1964, **66**, 55.

BEET FACTORY NOTES

Mechanism of aggregation of $CaCO_3$ particles in sucrose solution by the action of pectin. R. KOHN and A. MOJŽIŠ. *Listy Cukr.*, 1964, **80,** 7–15.—A study was made of the conglomerating effect on $CaCO_3$ particles of sodium pectate, which is the best form of pectin since it has zero esterification capacity. At 20 p.p.m. pectate, conglomeration occurred at +16·5 mV, but not at the other ζ-potentials (—3·1 to +4·0), unlike polymethacrylate. The aggregating capacity of the pectate depended considerably on the concentration of Ca^{++} ions in the suspension, the mechanism being one of direct interaction between the molecules of the polyanions in the pectate with the Ca^{++} ions adsorbed on the particle surfaces, with the formation of bridge linkages. With increasing Ca^{++} concentration, conglomeration reaches a maximum after which it decreases as a result of a reduction in the dissociation of the pectate carboxylic groups because of coagulation of the gelatinous Ca pectate where this joins the suspension. Thus thorough mixing of the pectate with the suspension is essential. The aggregating effects of apple and beet pectin and of sodium polymethacrylate on 1st carbonatation juice particles were compared. The polymethacrylate (PMA) gave far higher settling rates and lower mud volume after 25 min than the pectins. Similar results were obtained in comparison of PMA with raw and press juice added to 1st carbonatation juice.

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Defeco-saturation—"universal" method of juice purification. H. GRUSZECKA. *Gaz. Cukr.*, 1964, **72,** 8–13. A scheme developed by Cukroprojekt is described. Hot raw juice is pumped to a recirculation tank where it is mixed with 500% of 1st carbonatation juice. Milk-of-lime is fed automatically to the mixed juice flowing from the recirculation tank to the first of two carbonatation tanks in series; baffles in the pipeline ensure good mixing. Milk-of-lime is also added to juice entering the second of these tanks when poor juice is being processed when also only 300% of first carbonatation juice is recycled. Juice is brought to the required level of saturation for 1st carbonatation or may be sulphited in the second tank, is heated, filtered and again heated before 2nd carbonatation. The 2nd carbonatation juice is filtered, sulphited and again filtered. Using this process the invert content of thin juice has been reduced to 0·06–0·3% and gas utilization efficiency was 78·7% and 42·0% at 1st and 2nd carbonatation, respectively. Lime salts in thin juice was reduced considerably—to 114–235 mg on 100°Bx.

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The Mendota (California) new plant—U.S. newest operating beet sugar factory. ANON. *Sugar y Azúcar*, 1964, **59,** (2), 42–45.—At the new Spreckels beet factory, which has a planned daily slice of 3800 tons of beet, most of the processes and equipment are monitored and controlled from a central control room. Most of the information given on the factory concerns the control systems used. The pan station, governed from a single console, consists of 2 white, 2 intermediate and 2 raw pans. Fully automatic batch centrifugals are used. A DdS-type twin-scroll diffuser is among the equipment at the beet-end. No departures from standard processes have been made, even with the Steffen process which is remote controlled.

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The Hereford (Texas) new factory complex. ANON. *Sugar y Azúcar*, 1964, **59,** (2), 57–58, 75.—The new beet sugar factory of Holly Sugar Corp. will house the largest RT diffuser in the world (for a daily slice of 6000 tons of beet) and the first of its kind in the U.S. Other equipment includes Eimco rotary vacuum and U.S. Filter Corp. "Auto-Sluice" leaf filters, Goslin-Birmingham evaporators and pans, LaFeuille crystallizers, Western States fully automatic batch centrifugals and Silver-Hein, Lehmann continuous centrifugals. Provision is to be made for the storage of thick juice in five 1,800,000-gal plastic-coated steel tanks for inter-campaign processing. Fresh water will be supplied from five deep wells at 700 g.p.m., tapping the extensive water pool under the entire High Plains area in which the factory is located.

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Stream pollution—a major sugar industry problem? ANON. *Sugar y Azúcar*, 1964, **59,** (2), 62–64.—Eimco plant is used in Utah and Idaho to treat beet factory effluent. Impurities of 65 mesh are removed in a hydro-separator and after treatment the water is fed together with factory waste water (used in the washers and slicers and for plant cleaning and having high BOD) to an Eimco clarifier where the BOD is reduced by 40–60% and 99% of the settleable solids are removed. For greater BOD reduction a trickling filter is used, giving a total reduction of 75–80%. Post-chlorination can be used to effect further purification. The overflow from the clarifier is mixed with about 50% make-up water for re-cycling in the factory. The thickened sludge is pumped to a storage pond for disposal after the campaign.

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The effect of the evaporator station scheme on heat economy. S. ZAGRODZKI. *Gaz. Cukr.*, 1964, **72,** 1–8.—See *I.S.J.*, 1964, **66,** 196.

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New measurements of the respiration rate and sugar loss in stored beet. M. VAJNA-PAPP. *Zeitsch. Zuckerind.*, 1964, **89,** 67–73.—Tests to determine the effect of increase in atmospheric CO_2 and reduction in the oxygen on beet respiration rate and sugar losses showed that at 2% CO_2 the sugar losses in beet stored for 15 days at 8°C in a vessel were 65% of the

losses in the control. At 10% CO_2 the respiration rate was reduced by only a further 15% than at 2% CO_2 and the sugar losses were 56% of the control. However, further tests showed that the inhibiting effect of CO_2 on respiration was only temporary and that the respiration rate returned to normal once CO_2 was absent. Pre-treatment of fresh beet with tap or flume water caused no increase in the respiration rate. Beet from which about 10% moisture was removed before 30 min immersion in flume water at 20 and 40°C suffered greater sugar losses than the control (39% higher at the higher temperature) and mould formed. Storage in the presence of 2% and 10% CO_2 after 30 min immersion in flume water at 20°C resulted in sugar losses lower than in the control, but the results are only qualitatively sound.

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Coordinate geometrical solutions of sugar technology calculations. II. H. HAUCKE. *Zeitsch. Zuckerind.*, 1964, **89**, 74–80.—The author demonstrates calculation of total quantities by coordinate geometry[1]. The three groups of dimensions dealt with include yields whereby the water contents do not alter during processing (e.g. massecuite curing without steam or water washing) and yields where water is added or extracted during processing. Equations and diagrams are given for each process. A special device designed by the author for coordinate geometrical determinations of the various yield factors is described.

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Modern automatic computers and book-keeping machines instead of the traditional punched card system in the administration of Süddeutsche Zucker A.G. R. WEIHRAUCH. *Zeitsch. Zuckerind.*, 1964, **89**, 80–82.—A description is given of the new accounting system at Süddeutsche Zucker A.G. using computers and book-keeping machines (the latter with up to 50 memories). The advantages of this type of system over the punched-card system are discussed.

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Effect of decolorizing ion-exchange resins on the composition of juices and molasses. P. PAVLAS and M. FRAŇKOVÁ. *Listy Cukr.*, 1964, **80**, 27–35.—It was found that molasses from remelt liquor treated by "Wofatit EZ" ion-exchange resin (an *m*-phenylene diamine-formaldehyde copolymer) contained 20–25% less nitrogen than molasses from normally treated liquor. These conclusions were verified by chromatographic and electrophoretic separation of amino acids from resin regeneration solutions. Betaine was also found in these solutions. Chromatograms and an electropherogram are reproduced and details given of the amino acids present. The amino acids adsorbed by the resin were mainly neutral and basic. When thick juice was treated by ion-exchange, not only was colouring matter removed and the purity raised, but a certain amount of de-liming took place and amino acids and betaine were removed, reducing the nitrogen content by 6·8%. Crude beet saponin was found in the regeneration solution.

Drying of exhausted beet chips. M. ŠKRÁBAL. *Czechoslovak Heavy Ind.*, 1964, (3), 33–43.—Pulp pressing and drying for use as animal fodder, for pectin extraction or for cation exchange resins used to decontaminate radioactive waste is discussed with illustrated descriptions of Škoda machinery. This includes (i) the "Rapid 900" press, which produces a pulp of about 20% solids content at a daily throughput equivalent to a daily slice of 500–550 tons of beet of 4·5% pulp content; (ii) the DS 3 briquetting press; and (iii) a drum dryer which rotates at a speed of 1·4–2·8 r.p.m. and produces a pulp of 10–12% moisture content. The SU 4 crusher for pulp treatment before briquetting is also briefly mentioned.

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Classification of equipment in the beet sugar and refined sugar industry. M. R. AZRILEVICH. *Sakhar. Prom.*, 1964, **38**, 170–175.—Soviet beet factory and refinery equipment is classified according to type, size and throughput and information is given on types to be withdrawn and new types to be introduced in the future.

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Some problems in improving 2nd carbonatation. M. I. BARABANOV. *Sakhar. Prom.*, 1964, **38**, 185–188. The addition of lime at 2nd carbonatation is discussed. Tests were made of split liming in which 0·0, 0·25, 0·50 and 0·75% CaO (out of a total of 2·5% CaO) was added to filtered 1st carbonatation juice. Adding lime at 2nd carbonatation reduced the colour and lime salts and increased purity compared with the results when all the lime was used at pre- and main liming. The best results were achieved with 0·75% CaO at 2nd carbonatation. While dividing the total lime so that the second portion was 0·75% would so reduce the amount added before 1st carbonatation that filtration would suffer, this is now practical with the latest scheme where all thickened 2nd carbonatation muds are returned to pre-liming. Such recycling should be made continuous.

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New technique for acidifying diffusion waters in a sugar factory. A. LAPAIX. *Sucr. Franç.*, 1964, **105**, 71–75. The fully automatic unit described operates at constant head loss and is actuated by water passing into a hydro-injector. Vacuum is created which raises the level of inert liquid in one chamber to a fixed level and causes the counter-balance at the end of a beam arm to fall, compensating for head loss and actuating a needle value. This causes the vacuum effect to be transmitted to another chamber housing an SO_2 pressure valve governed by a float. In raising the level of the inert liquid, the vacuum introduces SO_2 which is then expanded, penetrating into a tube acting as a diaphragm and thus causing a drop in the level of the inert liquid equivalent to the SO_2 flow. The SO_2 then passes through the gap left by the opened needle valve and is absorbed by the water

[1] *See also I.S.J.*, 1964, **66**, 88.

in the hydro-injector. The unit, which has been in operation throughout the 1963 campaign, in a sugar factory, maintains the pH to within ±0·1.

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Turkey's Kastamonu sugar mill. T. M. OZIL. *Sugar y Azúcar*, 1964, **59**, (3), 36–37.—A very brief, but well illustrated, account of Kastamonu beet factory which began slicing in October 1963 is given. Although its rated daily slice is 1350 tons of beet, it sliced 61,000 tons of beet during the 1963 campaign, at a daily rate of 1640 tons.

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Influence of the foaming of low-grade massecuite on molasses viscosity and exhaustibility. K. WAGNEROWSKI, D. DABROWSKA and C. DABROWSKI. *Zeitsch. Zuckerind.*, 1964, **89**, 133–135.—See *I.S.J.*, 1964, **66**, 196.

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Contribution to evaporator cleaning. A. MÜEZZINOGLU and H. SCHUCH. *Zeitsch. Zuckerind.*, 1964, **89**, 136. Boiling out the evaporator at the author's factory with a mixture of caustic soda and milk-of-lime as described earlier[1] gave results (expressed in quantity of converted Ca oxalate) exceeding expectations and better than those obtained with soda and HCl. Scale was completely removed, no inhibitors were added, and the evaporator was re-started two hours earlier than with soda-HCl cleaning.

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Cooling sugar beet in clamps by spraying with water and by ventilation. N. T. KUDRYASHOV and A. M. KHELEMSKII. *Kholodil'. Tekh.*, 1963, (2), 40–45; through *S.I.A.*, 1964, **26**, Abs. 11.— Beets in southern parts of the U.S.S.R. may be stored for one or more months in warm dry weather. The new cooling method was tested at Korenovskii factory in 1958–61. A water pipeline was laid down the long axis of each clamp, with overhead sprays connected to it at 8 m intervals. Water (0·1–0·2 litre/50 kg of beet at a time) was sprayed at 2–4 hr intervals over thin reed mats covering the clamps. At night the clamp was soaked once with 1·5–2·0 litres of water per 50 kg of beet, before starting forced ventilation. Average sugar losses over a 71–84 day period were less than half the losses in control clamps. The forced ventilation at night let to a significant added reduction in sugar losses. The savings in sugar greatly exceeded the costs of treatment.

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Treatment of ammoniacal waters used for sugar extraction in diffusers. F. DOMSA. *Ind. Alim. Prod. Veg.*, 1963, **14**, 171–173; through *S.I.A.*, 1964, **26**, Abs. 13.—Treatment with weakly cationic ion-exchange resin is compared with acidification by sulphuric acid, SO_2, or both (water neutralized by H_2SO_4, then acidified to pH 5·8–6·3 by SO_2). Acidification requires careful control to avoid corrosion and ensure correct dosing, and increases the sulphate or sulphite concentration in factory liquors. Ion-exchange treatment does not have these disadvantages.

(Physical) state of vapour from a concentrated sugar solution boiling under vacuum. I. A. TRUB. *Izv. Vysshikh Ucheb. Zaved. Pishch. Tekhnol.*, 1963, (4), 134–135; through *S.I.A.*, 1964, **26**, Abs. 73.—The temperature and pressure of vapour leaving a boiling white sugar massecuite were measured in a pipeline taking vapour from three vacuum pans. A chart for a 24-hr period is reproduced. The vapour was superheated by 9–15°C, above the temperature of saturated vapour (~55°C at the prevailing vacuum), owing to the hydrostatic pressure at the heating surface.

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A simple method of checking the evaporator station during operation. T. BALOH. *Zucker*, 1964, **17**, 188–191.—An approximate evaluation of evaporator performance throughout the campaign can be obtained by means of a formula which is presented. This takes the form $k^* = \frac{D.\ \Delta\xi}{\Delta t\ \xi_a}$ where k^* = heat transfer coefficient, D = quantity of thin juice, $\Delta\xi$ = change in juice Brix in the evaporator, Δt = temperature difference between the calandria in the first effect (saturated steam temperature) and the vapour space in the last effect (°C), and ξ_a = thick juice Brix. D in the formula may be replaced by R (daily beet slice in tons). A worked example is given.

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Sugar refining at Kidderminster. ANON. *Evershed News*, 1964, **7**, (9), 11–16.—Information is given on the Evershed & Vignoles automatic controls of the diffusion and carbonatation processes at the Kidderminster factory of the British Sugar Corporation Ltd. The controls regulate the level of beet in the feed hopper to the slicers, the speed of the slicers and of the RT diffuser, the level of raw juice in the diffuser head tank, diffusion water supply and pH, raw juice flow, the raw juice and thin juice tank levels, milk-of-lime flow, and CO_2 addition to 1st carbonatation. All the above parameters are controlled from a central panel.

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Present state of the technique of juice, syrup and molasses decolorization by ion exchange. P. L. DEVILLERS. *Sucr. Franç.*, 1964, **105**, 101–103.—The article is a survey of the types of colouring matter encountered in a sugar factory, the types of decolorizing ion exchange resins used and their action on colouring matter, and the decolorizing techniques used (simple decolorization with strong anion exchangers, classic decolorization with a strong cation exchanger and a moderate anion exchanger, and inverse decolorization with a strong anion exchanger and a weak cation exchanger).

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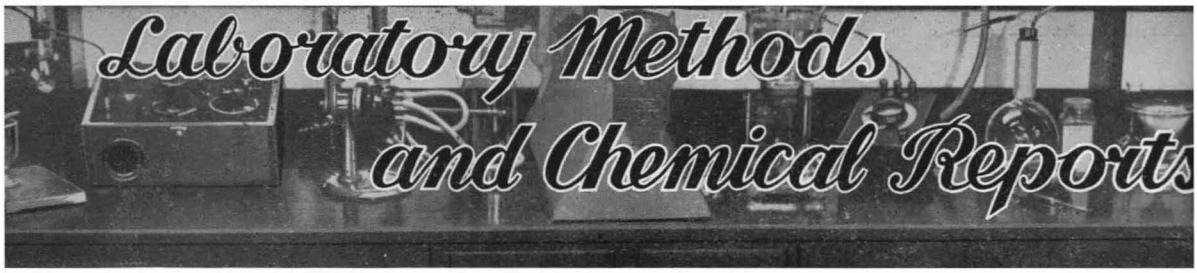
[1] STASEEV & TYAZHELOVA: *I.S.J.*, 1960, **62**, 104.



Molasses alkaline ash. E. A. GRIVTSEVA. *Sakhar. Prom.*, 1964, **38**, 121–123.—Determination of the K-Na ash in molasses as the difference between the total sulphate ash and calcium sulphate multiplied by 0·9[1] was compared with direct determination of the K-Na carbonate, whereby the K was measured colorimetrically as cobalt tricomplexonate and the Na determined complexometrically as sodium-zinc uranyl-acetate, the K and Na oxides being calculated as carbonates. The difference (% on molasses weight) between the results for 19 samples was 0·07 at a relative error of 0·9%. This difference was 0·41 (relative error of 5·6%) when the Ca salts were determined directly as Ca carbonate.

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Colorimetric method of determining small quantities of sucrose. L. D. BOBROVNIK and I. M. LITVAK. *Sakhar. Prom.*, 1964, **38**, 123–125.—Sucrose in water can be determined in the concentration range of 0·1–0·001% by mixing 1 ml of 0·1% α-naphthol solution with 2 ml test solution, then carefully adding 2·5 ml concentrated sulphuric acid. The test tube is then shaken for 30 sec and placed in a water bath (15–20°C) for 60 sec. The light absorption is then determined photocolorimetrically at 536 mμ. A calibration graph is given of sucrose content *vs.* light absorption. An empirical formula is given relating the sucrose content to the difference between the light absorption with and without sucrose. The method is accurate to within ±3%.

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Potassium and sodium determination in molasses. E. A. GRIVTSEVA and R. I. SUKHOMLIN. *Trudy Kiev. Tekhnol. Inst. Pishch. Prom.*, 1963, **27**, 55–60.—Potassium in molasses was precipitated with sodium cobaltinitrite and the precipitate dissolved in 1:4 EDTA-hydrogen peroxide solution. In the presence of potassium, the colour of the cobalt tricomplexonate ranges from pink to red according to the K concentration. The colour was measured photocolorimetrically at 530 mμ and the K content read from a calibration curve. Good agreement was found between the values determined by this method and by flame photometry. Sodium in molasses ash solution was determined by precipitating with zinc uranylacetate; the zinc in aqueous solution of the precipitate was determined with EDTA using Eriochrome Black T as indicator, after adding ammonium carbonate to keep the uranium in solution as a carbonate complex. Comparison between the results and those obtained with flame photometry showed good agreement with a maximum difference of 0·1%. Accurate determination of sodium directly in molasses was prevented by the organic non-sugars complex in molasses which made complete precipitation of the Na impossible.

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"Standard" Brix of molasses. K. WAGNEROWSKI, D. DABROWSKA and C. DABROWSKI. *Gaz. Cukr.*, 1964, **72**, 14–19.—The standard Brix of Polish molasses samples, i.e. corresponding to 44 poises viscosity, was measured at a purity of 52·0–61·5 and a temperature of 30–60°C and standard conditions (found to be 85·3°Bx at 47·4°C). Details are given of the techniques for molasses preparation, rapid Brix determination (after 1:1 dilution) and temperature measurement. The relationships between standard Brix and molasses standard purity were investigated. Standard Brix was found to rise by about 0·02° per unit purity rise, although no valid correlation was established between these rises. An empirical formula relates standard Brix with temperature, viz. $Bx_0 = 0{\cdot}21\,t + 75{\cdot}2$ at $t = 30$–60°C.

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Osmophilic yeasts in the food industry and a new technique for their determination with a paper method. B. HYLMAR and V. ORSZÁGHOVÁ. *Listy Cukr.*, 1964, **80**, 18–23.—The great harm done by osmophilic yeasts which grow on products of high sugar content is discussed and means of preventing this by controlling every phase of production are considered. The OK paper method described for bacterial count determination consists in impregnating a paper strip of known adsorption capacity with a culture composed of yeast extract (10 g), malt extract (20 g), peptone (5 g), glucose (100 g) and agar (5 g). The strip is soaked in the test sample and allowed to develop in a sealed jar. The infection is then expressed as the count per ml or per g of dried sample. Three versions of the method, which is suitable where there is a lack of bacteriologists and equipment, are described.

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Comparison of boiling house efficiency in sugar factories—derivation of a simple formula equivalent to that of Noel Deerr. B. L. MITTAL. *Proc. 31st Ann. Conv. Sugar Tech. Assoc. India*, 1963, 61–69.—The applicability of the Deerr formula for calculating reduced boiling house recovery to factory conditions is discussed. The two main defects mentioned are that it is biased on the side of low purity juices and assumes a constant molasses purity. The present author develops a formula which is shown by tabulated data to give the same results as the Deerr formula and is recommended since it is simpler. The formula

[1] SILIN: *I.S.J.*, 1962, **64**, 145.

takes the form $R_{85} = 1 - \frac{3\ Pl}{17\ Nm}$, where R_{85} = reduced boiling house recovery at 85 mixed juice purity, Pl = sucrose lost in boiling house % cane, and Nm = non-sugars in mixed juice % cane.

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An easy method for the determination of soluble ash in white sugars. S. K. D. AGARWAL and B. I. NEMADE. *Proc. 31st Ann. Conv. Sugar Tech. Assoc. India*, 1963, 77–79.—Where there is lack of equipment for conductivity ash measurements, the ash in 50% white sugar solutions can be determined by titrating with M/560 EDTA solutions, using Eriochrome Black T indicator, and referring to a calibration curve prepared from parallel conductivity measurements. The method is applicable only to fresh, undeteriorated samples.

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A new spectrophotometric method for estimation of reducing sugars in sugars. S. K. D. AGARWAL. *Proc. 31st Ann. Conv. Sugar Tech. Assoc. India*, 1963, 81–84.—In this method 50 g of white sugar is dissolved in about 50 ml water, 10 ml 5N NaOH added and the volume made up to 100 ml. The colour is then measured at 415 mμ and again after the solution has been heated for 8–10 min in a boiling water bath. The reducing sugar content is given by reference to a calibration curve. The method is based on the fact that in the presence of alkali, sucrose does not caramelize when heated, unlike reducing sugars. Raw sugar solutions must be clarified with lead subacetate and de-leaded before heating.

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Colorimetric studies of gur. A. J. DANGRE. *Proc. 31st Ann. Conv. Sugar Tech. Assoc. India*, 1963, 99–103.—Gur samples (3·25 g in distilled water subsequently made up to 100 ml) were filtered through asbestos under vacuum and the optical densities measured photocolorimetrically at wavelengths in the range 420–660mμ. In a graph of absorption (–log t) *vs.* wavelength, the wavelengths in the range 540–590 mμ were expressed by almost straight lines. The absorption index –log t at 560 mμ could thus be obtained by interpolation between 540 and 590 mμ with sufficient accuracy for routine purposes, as is shown by comparison between calculated and measured values.

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Studies of gur qualities in Maharashtra State. A. J. DANGRE. *Proc. 31st Ann. Conv. Sugar Tech. Assoc. India*, 1963, 105–113.—Gur from four areas of Maharashtra was analysed and the samples divided into four grades. The tabulated data show wide divergences between grades and between samples from different zones in the same grade. Despite the variations in composition, an attempt is made to define limits for each grade, grade 4 gur being considered classifiable only as molasses.

Caramel as indicator in acid base titrations. S. K. D. AGARWAL and M. B. KUMAR. *Proc. 31st Ann. Conv. Sugar Tech. Assoc. India*, 1963, 203–206.—The composition of caramel is discussed. Two caramel solutions were made up (i) by heating pure sucrose at 190–200°C for about 30 min, and (ii) by alkaline degradation of glucose. The effect of pH change on the colour was determined and the caramel found to undergo a colour change over a range of 6 pH units. The pK of the two caramel solutions differed, indicating differences in the composition. Both underwent a colour change from yellow to dark brown when a strong acid was titrated with a strong base and the end-points obtained were identical. The caramel was found to be unsuitable for titration of strong acid with weak base or weak acid with strong base.

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Studies on the sugar crystals. S. K. D. AGARWAL and B. I. NEMADE. *Proc. 31st Ann. Conv. Sugar Tech. Assoc. India*, 1963, 257–264.—The effect of impurities on the viscosity of refined and raw sugars was studied. It was found that viscosity was independent of the ash content, and that the type of impurities rather than their total content is significant. Impurities included in sugar crystals were found to be different from those in the mother liquor and probably co-crystallized with the sucrose. Most of the inorganic salts examined tended to lower sucrose viscosity. Heat or alkaline degradation products such as caramel syncrystallizing with sucrose increase viscosity if produced during storage. Such substances as gums (dextran) and pectins cause a considerable increase in viscosity. While the ash content of refined sugar samples was low, the viscosity was much higher than that of pure sucrose. No relationship was found between the viscosity of the sugar crystals when dissolved and their purity. No difference was found in the behaviour of carbonatation and sulphitation sugars with respect to viscosity, conductivity ash, CaO and colour, whereas the products of deterioration in the two types of sugar were different.

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Report on sugar and sugar products. E. J. MCDONALD. *J.A.O.A.C.*, 1964, **47**, (1), 69–71.—A condensed form of the table of refractive indices of invert sugar solutions determined by SNYDER & HATTENBURG[1] is presented for 15, 20, 25 and 30°C and concentrations of 0·85% invert sugar (weight in air) at 5% intervals. The values are to five decimal places and differ from values obtained by ZERBAN & MARTIN in the fifth place. Also presented (in entirety) are the densities of invert sugar solutions determined by SNYDER & HATTENBURG at the same four temperatures and concentration range (% weight in vacuum) but at 1% intervals.

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Determination of raffinose in sugar products. A. DRABIKOWSKA. *Gaz. Cukr.*, 1964, **72**, 38–42.—The formation of raffinose in beet and its properties are

[1] *I.S.J.*, 1964, **66**, 270.

described and a survey is presented (43 references) of quantitative determination methods, including polarimetry, paper and column chromatography and electrophoresis.

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Determining Brix of beet sugar products without dilution. T. P. KHVALKOVSKII. *Sakhar. Prom.*, 1964, **38**, 197–200.—The Brix of various molasses and run-offs and of *A* and *B* massecuites was determined refractometrically using the 1:1 dilution method and without dilution. Without dilution the Brix reading was lower than with dilution (by 1·2–1·3°Bx with massecuites and by 1·4–1·8°Bx with molasses). This difference is attributed not to crystallization when the sample is cooled rapidly, but to contraction of the solutions with dilution. Procedures for Brix determination without dilution are described.

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Detection of phenolic compounds by chromatography in beet sugar molasses. Y. OBATA, Y. SENBA and M. KOSHIKA. *Agric. Biol. Chem.* (Japan), 1963, **27**, 340–341.—Phenolic compounds were extracted from molasses diluted with water (1:1) by absorption with active carbon suspended in 95% ethanol, and were separated from other material by extracting successively into ether, 3% NaOH and again in ether. The phenolic compounds were separated by column chromatography on activated alumina and fractions were identified by ascending paper chromatography. The main solvents used were: water-saturated butanol (on paper previously sprayed with phosphate buffer of pH 7 and dried); 1:1:2 pyridine:butanol: saturated NaCl; and 4:1:5 butanol:acetic acid:water. *Rf* values and colour reactions with diazotised *p*-nitroaniline and diazotised sulphanilic acid demonstrated the presence of catechol, *p*-hydroxybenzoic acid, melilotic acid, salicylic acid, syringic acid, vanillic acid, vanillin and three unidentified compounds.

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Assertions of an empirical type on rate of crystallization in supersaturated sugar-water solutions. H. TONN. *Zeitsch. Zuckerind.*, 1964, **89**, 131–133. — While diffusion index values earlier determined by the author were considerably lower than those given in the literature, the calculation being based on the hypothesis that the boundary layer thickness was equal to the radius of an equivalent sphere, a suitable expression was obtained for calculating the rate of material transfer from the change with time of the equivalent crystal sphere radius. This was checked against the MOLLER & SCHMIDT diagrams[1] by equating the radius growth with the growth of the *b* axis as observed by Moller & Schmidt. This leads to a correction of the author's earlier expression for determining the rate of material transfer. The diagrams have also enabled the author to express the change in the growth rate with purity more specifically. An equation is presented for growth rate calculations. Calculated values agree satisfactorily with those given by the Moller & Schmidt diagrams, but should be checked more fully against experimental data.

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Thin-layer chromatographic determination of raffinose in molasses. V. PREY, W. BRAUNSTEINER, R. GOLLER and F. STRESSLER-BUCHWEIN. *Zeitsch. Zuckerind.*, 1964, **89**, 135–136.—Six 1 µl spots of molasses solution (5 g/100 ml distilled water) are applied at 3 cm intervals to a plate coated with silica gel G and well dried. Raffinose spots of concentrations increasing from 0·5 µg to 1·0 µg in 0·1 µg intervals are alternated with the molasses spots. The plate is again dried, cooled and chromatographed with 9:1 acetone-water for 30–40 min. The solvent is evaporated and the plate sprayed with a solution made up of 0·2 g naphthoresorcinol in 100 ml ethanol + 10 ml phosphoric acid. The colour is developed at 100–110°C. The raffinose content can be determined to within ± 0·05 g (± 0·1%). Kestose can also be separated from the other saccharides with the acetone-water solvent. *Rf* values of sucrose, raffinose and kestose were, respectively, 0·49, 0·12 and 0·15.

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Chromatography of sugars on thin films of calcium silicate. J. P. TORE. *J. Chromatogr.*, 1963, **12**, 413–415; through *S.I.A.*, 1964, **26**, Abs. 49.—Sugars were separated on ~0·2 mm films of a hydrated calcium silicate activated for 15 hr at 110°C, or of a 110:30:7 mixture of the silicate with "Celite 535" and sodium acetate. The solvents used were *n*-butanol:water (100:14) or *n*-butanol-butyl acetate:water (92:8:14). The spots were revealed with ammoniacal $AgNO_3$ which contained a little sodium acetate.

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Thin-layer chromatography of carbohydrates on gypsum. YU. A. ZHDANOV, G. N. DOROFEENKO and S. V. ZELENSKAYA. *Doklady Akad. Nauk S.S.S.R.*, 1963, **149**, 1332–1333; through *S.I.A.*, 1964, **26**, Abs. 50.—The preparation of plates covered with a thin layer of $CaSO_4$ is described. Chromatographic separation is very rapid (40–45 min). Monosaccharides were separated in chloroform:methanol (19:2 or 19:3) and disaccharides were separated in 19:5 chloroform:methanol from alcoholic solutions of the mixed sugars. The spots were revealed with alkaline $KMnO_4$ and sodium metaperiodate solution, $AgNO_3$ in aqueous acetone, or concentrated H_2SO_4 followed by infra-red heating.

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New spraying agent for reducing sugars on paper chromatograms. T. MOMOSE and M. NAKAMURA. *Talanta*, 1963, **10**, 115–116; through *S.I.A.*, 1964, **26**, Abs. 51.—The air-dried chromatogram is sprayed with an alkaline solution of 3,6-dinitrophthalic acid (0·4 g of potassium 3,6-dinitrophthalate in 100 ml, followed by 2·0 g of K_2CO_3), again air-dried, and heated at 100°C for 3 min. Reducing sugars are revealed as wine-red spots (sensitive to 0·2 µg of glucose or fructose). The reagent is stable for a long time.

[1] *Zeitsch. Zuckerind.*, 1963, **88**, 501–504; *I.S.J.*, 1964, **66**, 127.

BY-PRODUCTS

Vaporizing area in distillation column a controlling factor for capacity. B. B. PAUL and A. K. MITRA. *Proc. 31st Ann. Conv. Sugar Tech. Assoc. India*, 1963, 85–92.—Details are given of the modifications made to the distillation columns at Daurala distillery to increase the vaporizing area from 10% of tray area to 15·4% and increase the daily absolute alcohol production. To effect this, the bubble cap plates were re-designed and the cross-flow pattern changed.

* * *

Sugar cane wax. IV. Composition of the saturated fatty acids occurring in the fatty matter of crude sugar cane wax. Y. P. KAPIL and S. MUKHERJEE. *Proc. 31st Ann Conv. Sugar Tech. Assoc. India*, 1963, 199–201.—The composition of the saturated fatty acids occurring in the fatty matter in crude cane wax was determined. These constituted 54% of the fatty matter and the following acids were found: palmitic (15·4%), stearic (10·2%), arachic (22·5%), behenic (6·2%), oleic (1·6%); the residue (44·1%) was higher than behenic acid. Details are given of the analysis techniques.

* * *

Raw sugar molasses as cattle fodder. J. P. SHUKLA, K. A. PRABHU and A. K. NIGAM. *Proc. 31st Ann. Conv. Sugar. Tech. Assoc. India*, 1963, 223–228. Indian molasses samples have been analysed with a view to the use of molasses in animal feedstuffs. The analyses of white and raw sugar molasses are compared with those of American blackstrap and refinery molasses and further analyses are given of molasses-bagasse (1:1 and 3:1 mixtures), bagasse-molasses-groundnut cake (2:3:2) and bagasse-molasses-yeast (3:3:2). The vitamin B content of molasses has also been analysed.

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Further investigations on treatment of distillery effluents by anaerobic digestion. J. P. SHUKLA and R. L. SRIVASTAVA. *Proc. 31st Ann. Conv. Sugar Tech. Assoc. India*, 1963, 229–234.—It was found possible to reduce the pollution load in distillery effluent by about 12% by removing the suspended yeast sludge in a centrifuge at 3000 r.p.m. The yeast could be used as chicken fodder. The optimum feed rate (volatile matter) in the digestor was found to be 1600 mg/litre/day and the optimum volatile acidity with 4 litres of active methane culture added per 100 ml effluent was 2250 mg/litre. At 3600 mg/litre digestion ceased completely. The effect of lime on bacterial count and activity was studied. After 6 days there was a fall in the bacterial population and after 9 days no gas was produced by effluent neutralized with lime to pH 7·0.

* * *

The effect of different supplements on the fermentation process in silage. L. SVENSSON and M. TVEIT. *Socker Handl. II*, 1963, **18**, 85–89.—Molassed pea-straw meal and sucrose, followed by molasses, had the best effect (among a number of additives under test) in inducing sufficient lactic acid formation to preserve silage from the adverse effects of butyric acid bacteria and putrefactive bacteria which cause loss of protein. Addition of lactic acid bacteria to molasses had no additional effect compared with molasses alone. The molassed meal also reduced loss of dry matter by absorbing effluent.

* * *

Problems of aeration and circulation in aerobic fermentation vats. L. LEFRANÇOIS. *Ind. Alim. Agric.*, 1964, **81**, 13–18.—The discussion of air feed and circulation of the charge in continuous fermenters is restricted to fodder yeast and includes brief mention of types including the Lefrançois-Mariller fermenter. The advantages of this design are given with some information on power consumption for various materials, including beet vinasse and molasses.

* * *

Cane molasses in cattle feeding. R. MACIAS N. *Mem. V Conf. Int. Inst. Técn. Azuc. Veracruzano*, 1961, 173–178.—Cattle rearing for milk, meat, etc. in Mexico is less than adequate to meet the demand for these products and a contributory cause is the shortage and high cost of feeds. The advantages of molasses as feed are discussed and reference is made to the findings of other workers on the effects of cattle feeding with molasses. Methods of feeding are given, as is a formula which gives satisfactory nutrition, production and animal health. Differences between this and other formulae are discussed and the mechanism for its utilization by the animal is explained.

* * *

Sucrochemistry—its origin and applications. J. L. HICKSON and A. K. MITRA. *Indian Sugar*, 1963, **13**, 549–555.—Information is given on the Sugar Research Foundation Inc. with details of the money spent on various projects. The chemical properties of sucrose are described followed by discussions of the various types of products in which sugar may be applied: adhesives, plastics and plasticizers, fibres and films, surface coatings and surface-active agents.

* * *

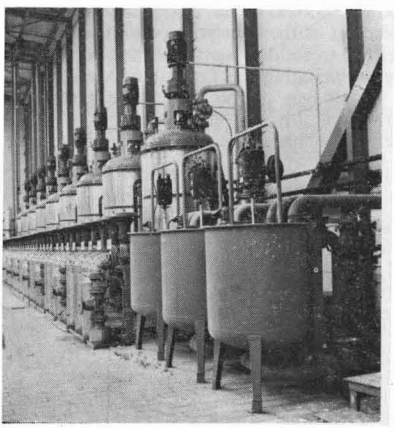
Nitrogen-containing fatty acid esters of sugar. R. M. ISMAIL and H. SIMONIS. *Angew. Chem.*, 1963, **75**, 1102; through *S.I.A.*, 1964, **26**, Abs. 36.—Sucrose 12-aminostearate, 12-ketoximinostearate, 9-hydroxy-10-dimethylaminostearate + 10-hydroxy-9-dimethylaminostearate, and 9-acetoamidostearate+10-acetoamidostearate were prepared by transesterification with methyl esters. Their melting points, surface tensions, washing powers and nitrogen content are tabulated. They are 100% bacterially degradable.

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.

Funda filters. Chemap AG., Männedorf-Zürich, Switzerland; Alfa-Laval Co. Ltd., Great West Rd., Brentford, Middlesex.

The illustration shows a battery of nine Funda pre-coat filters installed in a sugar factory; three dosing tanks with "vibro-mixers" appear in the foreground. There are two types of Funda filter: the dry-residue and pre-coat models. The latter discharges the filter cake as a slurry while the former discharges either a slurry or a semi-dry or dry product. Both



types feature automatic cleaning systems and have to be opened only infrequently for periodic inspection. A motorized vertical shaft spins the filter discs at speeds high enough to throw off the residue by centrifugal force.

The filter is a pressurized vessel with horizontal leaves on which the cake is distributed very evenly, resulting in high washing efficiency. The cake may be dried with steam, by vacuum, etc. and discharged as a dry or damp solid.

* * *

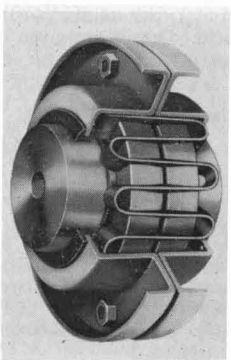
Fluidized bed dryers. Fluostatic Ltd., Borough Green, Kent.

A series of dryers for handling granular solids from 100-mesh to ¾-inch consists of a cylindrical shaft separated into an upper and a lower compartment by a perforated plate. The material to be dried is fed into the upper compartment and forms a bed 12–18 inches deep on the plate; hot gas (which may be produced by burning fuel in a chamber attached to the lower compartment) passes through the plate from the lower compartment, fluidizing the bed and carrying off any entrained dust. Dried material flows like a liquid into an outer chamber and out through a discharge pipe while the gas passes through a dust separator before escaping to atmosphere. Instruments record air flow, pressures, gas inlet and exit temperature. Capacities are from 1 to 200 tons/hr and can reduce moisture content from 30–50% to less than 0·1% without raising the temperature above 105°C. Fuel and maintenance costs are low and the system can operate fully automatically. The dryers are suitable for sugar and other heat-sensitive materials.

* * *

"Flexacier" flexible couplings. E. T. S. (Lonertia) Ltd., Prudential House, Wellesley Rd., Croydon, Surrey.

The basic design of this coupling centres around that of connecting two grooved discs, one on the driving and the other on the driven member, by a grid spring. Grooves are cut axially around the peripheries of the discs and a specially designed



spring runs through the grooves to form a series of resilient bridges. The system accommodates angular, parallel and axial misalignment between units and absorbs considerable torque overloads. The springs are of special steel and operate in a synthetic rubber-sealed grease casing which requires topping-up only once a year. Instances of their applications include 60,000 h.p. reversible blooming rolling mills and 20,000 h.p. diesel engines.

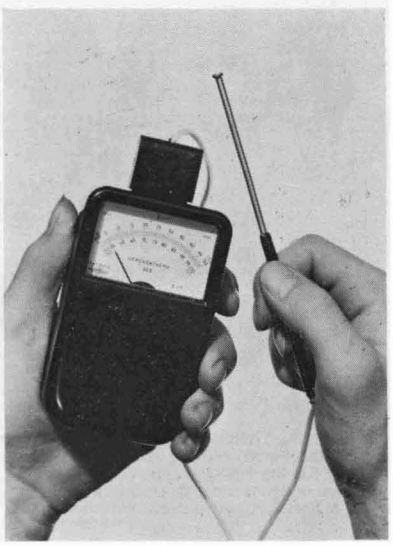
* * *

"Dependatherm" electronic thermometers. Kane-May Limited, 243 Upper Street, London N.1.

Instantaneous, highly accurate temperature measurements can be carried out with the new "Dependatherm" electronic thermometer, a pocket size intrument in which advanced circuit techniques are employed to ensure exceptional long term stability. Measurements are displayed on a 2½-inch dial immediately upon application of a small pencil shaped probe to the temperature source.

The rapid response of the new instrument to temperature fluctuations permits particularly close supervision of process, and probes can be used for

temperature measurement of air, gas, liquids, granular solids and solids. Measurement of the operating temperature of machinery is greatly facilitated and the instrument is equally suitable for production and laboratory applications.



"Dependatherm" electronic thermometers embody automatic stabilization circuits which obviate any form of pre-test balancing (the instrument is immediately ready for use) and which ensures that the accuracy of indication is unaffected, over wide limits, by the gradual decline of the battery voltage. A standard 9 volt transistor-type battery is employed.

Single-range and multi-range versions are available covering one or more temperature spans within the range of 0°–200°C or 32°–350°F. Standard probes of various designs and special probes to meet particular needs in the engineering, chemical and process industries are available. Inter-connexion leads between probe and instrument may be up to fifty feet long. The instrument measures $4\frac{1}{2} \times 2\frac{1}{2} \times 1\frac{1}{2}$ inches and weighs $7\frac{1}{2}$ oz.

* * *

"Safran" series Ace pumps. Saunders Valve Co. Ltd., Cwmbran, Monmouthshire.

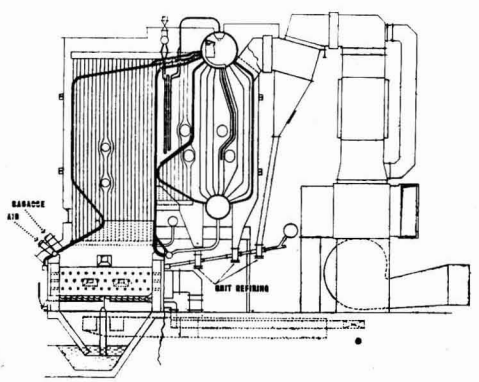
Augmenting the established range of "Safran" SCE Unishaft pumps is the new series of ACE models. These five new pumps in sizes from $\frac{3}{4}$ to $2\frac{1}{2}$ in, whilst enabling many intermediate duties in the double range to be conveniently met, have also been designed to reduce initial cost. The principle of the bulkhead mounting bracket has been retained and, although of different pattern, permits the perfect alignment of pump and motor unit by bolting to its machined front and rear faces. The front face of this bracket, by forming the back cover of the pump volute, effects a substantial economy in production. The ACE pump, as in the SCE type, is driven by the extended motor shaft. A mechanical seal is standard on the smallest model and optional, instead of a graphite packed gland, on the other sizes. A wearing sleeve is normally fitted for protection of the motor pump shaft. Standard motors are of squirrel cage induction type, but totally enclosed or flameproof motors can be supplied on request. Duties range from 12 to 170 g.p.m.

* * *

Automatically controlled bagasse-fired boilers in Mauritius. Babcock & Wilcox Ltd., 209 Euston Rd., London N.W.1.

In Mauritius where Babcock boilers are widely used, three bagasse-fired Bi-drum boilers are now in service, a feature of which is the automatic control to maintain steam pressure within close limits, presenting special problems with such a variable fuel as bagasse.

Another design feature is that each boiler incorporates a special Ward furnace, in this instance with two hearths, each hearth having a dumping grate comprising four sections. Water-filled ash hoppers beneath the sections receive the dumped material which is quenched by the water. Forced draught to compartments corresponding with the dumping grate sections above is cut off to each section in turn as the ash is dumped. Ashes are flushed periodically from the hoppers, an arrangement which affords the strictest economy of water. Incidentally, such de-ashing allows fully automatic steam plant operation.



Two of the boilers, of 77,000 lb/hr capacity, are installed at Medine Sugar Company, while one of 66,000 lb/hr is at Britannia Sugar Estates. A further 66,000 lb/hr boiler is being installed at Britannia's associated mill at Highlands, and an 88,000 lb/hr unit has recently been ordered by Mon Désert-Alma Sugar Company, both having the same firing and ash-removal features. Designed by Babcock & Wilcox

these contracts are being handled through Babcock & Wilcox of Africa (Pty.) Ltd.

* * *

Standard electric motors up to 1000 h.p. Mather & Platt Ltd., Park Works, Manchester 10.

The established standard dimension motors of up to 150 h.p. have been augmented by a similar range of standard motors up to 1000 h.p. It is available for voltages up to 6600V in squirrel-cage or slip-ring types, ventilated or totally-enclosed.

* * *

PUBLICATIONS RECEIVED

ENDECOTTS FOR ACCURACY. Endecotts (Filters) Ltd., Lombard Rd., London S.W.19.

Under this title appear two new leaflets on the B.S. and A.S.T.M. Test Sieves made by Endecotts, the specifications of which are tabulated, together with a description of the "Endrock" test sieve shaker which is available in three sizes to hold various numbers and sizes of sieves. Also described are the pocket-size "Interchanger" sieves which are of only 4 inches diameter but are made to the same standards of accuracy as the larger B.S. and A.S.T.M. sieves.

* * *

STORD PRESS REVIEW. Stord Bartz Industri A/S., Bergen, Norway.

A new house magazine in English has been produced under this name by the manufacturers of the Stord beet pulp press. The first two issues contain much information on the advantages of the press and experience with it is various countries of the world. Sales of presses are recorded as they are also in a separate "Reference List" published by the Company. In addition each issue of the Review carries an article on the city of Bergen and an aspect of the manufacture of presses in the Stord Verft works.

* * *

SPRINKLER IRRIGATION OF SUGAR CANE. Wright Rain Ltd., Crowe, Ringwood, Hampshire.

This new 12-page pamphlet provides a great deal of useful information on irrigation generally as well as sprinkler irrigation, indicating the advantages of the latter, especially as a Wright Rain installation. The pumps, aluminium pipes, elbows, couplings and sprinklers manufactured by the Company are described and illustrated, and an interesting feature is the planned irrigation layout drawn up for a sugar estate of 1300 acres. Also provided are layouts of irrigation schemes using large ("Master" 44 g.p.m.) sprinklers on light/medium loam and small ("Lancer" 8·7 g.p.m.) sprinklers on medium/heavy loam, the latter for use with only daytime or both day and night-time moving of pipes.

* * *

CANE FARM MACHINERY. Massey-Ferguson (Export) Ltd., Banner Lane, Coventry, Warwickshire.

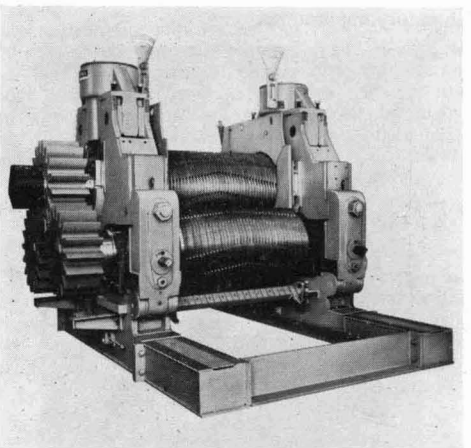
A series of leaflets is available describing the wide range of mechanical aids to the cane farmer produced by the Massey-Ferguson organization in Australia, North America, France, Italy and South Africa, as well as the United Kingdom. The equipment includes ranges of tool carriers, loaders, terracers, utility and multi-purpose blades, graders, diggers, disc, chisel and mouldboard ploughs, field tillers and disc harrows, and cane trailers, as well as wheeled and crawler tractors of various sizes and powers.

* * *

THE DON HSS1 STUBBLE SHAVER. Wyper Bros. Ltd., Bundaberg, Queensland, Australia.

Stubble shaving assists cultivation and growth, according to a small leaflet which illustrates this machine, developed and built in Queensland, and lists its advantages.

New Farrel cane mill design.—A particular feature of a redesigned and modified series of standard Farrel cane mills in the 42–84 inch range is the use of welded steel instead of cast housings. This permits lower-cost manufacture with no



sacrifice in the strength and rigidity of the mill. Other features distinguishing the Farrel mill are retained: pinned top cap, ladder bearing for top roll float, etc. One of three 32×60 in mills to the new design recently shipped by Farrel Corporation to Ingenio La Joya S.A., in Mexico, is illustrated.

* * *

New basket design for Western States continuous centrifugal. The basket on the Western States continuous centrifugal is a new and unique approach to design of this equipment. It has more than 70 parallel, horizontal grooves machined on the inside wall and more than 1000 holes drilled through the wall before dynamic balancing. This arrangement provides for efficient elimination of the mother liquor and uniform support of the filtering medium; the groove lends support to the filter lining without the need for a backing screen. Additional features include a variety of linings to suit the application, the accelerating bowl serves as a filter lining clamp at the bottom of the basket, and the over-running slinger seal design effectively prevents solid-liquid compartment interleakage.

* * *

Transload station for harvested cane.—A prototype machine designed by R. A. DUNCAN of International Cane Machinery Corporation has proved successful in its first year of operation. It receives whole-stalk cut cane from field vehicles by means of an unloading net and separates soil and fine trash. The cane is then cut into 18–24 inch lengths and trash removed by heavy air blasts. The station has a capacity of some 2½ tons per minute and removes about 50% of the trash, including tops; this figure should be increased to 75–85% in a commercial unit. The station is portable and can be easily moved from one harvest field to another. It is anticipated that there will be a market for such machines during the transition from hand cutting to fully mechanized harvesting so as to permit a uniform supply of chopped cane to the factory.

* * *

Automation in analytical chemistry.—The 1964 Symposium organized by Technicon Instruments Co. Ltd. to mark their 25th Anniversary will take place at Edward Lumley Hall, Royal College of Surgeons of England, Lincoln's Inn Fields, London, W.C.2. It is anticipated that over 80 papers will be read during the 3 days of the Symposium—12th to 14th October—and the proceedings will be published in due course. The first day will be devoted to industrial applications, the second to biochemistry and research, and the third to clinical applications.

Canada Sugar Imports[1]

	1963	tons 1962	1961
Raw sugar imported by refiners			
Australia	130,328	167,214	162,359
Barbados	7,353	20,137	39,612
Brazil	2,069	8,744	—
British Guiana	89,292	83,100	115,440
British Honduras	2,958	6,362	6,138
Cuba	62,255	14,200	35,258
Ecuador	—	3,200	—
Fiji	68,883	43,062	31,296
French West Indies	—	—	1,978
India	93,488	106,066	—
Jamaica	80,008	103,766	104,637
Leeward/Windward Islands	10,240	15,031	10,497
Mauritius	49,090	66,596	78,773
Peru	3,616	—	—
Rhodesia/Nyasaland	18,862	—	—
South Africa	77,835	49,397	35,916
Trinidad	27,548	40,464	41,663
	723,825	727,339	663,567
Raw sugar N.O.P.			
Australia	—	74	—
British Guiana	724	1,776	2,258
Cuba	3,956	1,230	11
Dominican Republic	4,570	7,164	4,243
French West Indies	—	4,069	4,114
India	81	22	—
Jamaica	61	—	—
South Africa	74	—	—
United States	22	—	—
	9,488	14,335	10,626
Refined sugar			
Belgium/Luxembourg	148	—	—
France	148	—	—
Germany, West	12	—	—
Holland	4	2	1
Panama	178	—	—
South Africa	40	—	—
United Kingdom	918	1,010	3
United States	5,517	53	9
	6,965	1,065	13

BREVITIES

Guinea sugar refinery plan[2].—The construction of a sugar refinery in Guinea has been proposed by the Economic Development Minister as part of an industrial development scheme which is to be spread over the next seven years, reports Reuter.

* * *

Mozambique sugar exports[3].—Exports of sugar from Mozambique during 1963 amounted to 124,896 metric tons, according to "The Standard Bank Review". This compares with 129,931 tons in 1963 and 113,843 tons in 1961.

* * *

Brazil sugar expansion[4].—An agreement has been signed between the Instituto Brasileiro do Cafe (IBC) and the Instituto do Açucar e do Alcool (IAA) providing for financing the cost of establishing sugar plantations and mills in areas where coffee is produced uneconomically. The resources will be provided by the Grupo Executivo de Racionalização da Cafeicultura (GERCA). According to Sr. Michaelson, Minister of Industry and Commerce, the sugar plantations and mills should provide employment for 50,000 workers.

Fiji sugar expansion.[5]—A programme for the expansion of the sugar industry in Fiji was announced recently by the General Director of the South Pacific Sugar Mills Ltd. The plan provides for a production of 330,000 tons in 1965 and for 350,000 tons in 1966. In 1963 production amounted to 299,000 tons and an outturn of 300,000 tons is expected for the 1964 season. The Fiji Sugar Board has approved the expansion plans, the most important reasons for which are the good outlets on the world market.

* * *

Cameroun sugar plans[6].—With the support of the Ministry of National Economy a sugar company has been established in Cameroun to process locally grown cane. It is expected that some ten thousand tons of refined sugar will be produced annually, reports Reuter. Production, however, is not expected to start before 1967.

* * *

Syria sugar factory tender[7].—An international tender is to be called for the erection of a sugar plant in Jisr-el-Chughour, Syria.

* * *

Japanese sugar factory for Indonesia[8].—Japan and Indonesia have signed a contract to establish a sugar factory on Ceram Island in East Indonesia, according to a report from the official Antara news agency. The factory, which will increase Indonesia's sugar production by about 35,000 tons a year, will be on a production-sharing basis.

* * *

Analytical control methods in Mauritius[9].—A new book has been published in Mauritius entitled "Official Methods of Control and Analysis for Mauritius Sugar Factories." It has been published by the Société de Technologie Agricole et Sucrière de Maurice and will replace their "System of Chemical Control for Cane Sugar Factories" which was published in 1948. It contains methods conforming to those recommended by the I.S.S.C.T. in their 1956 book on chemical control, with the exception of more recent methods submitted by the Analysis Committee of the I.S.S.C.T. at the last two congresses. The book is available in bound form from Librairie du Trèfle and Librarie Sénèque in Mauritius, at a cost of 15 rupees.

* * *

Sugar project for Ghana[10].—The F.A.O. has announced that the Government of Ghana intends to devote to sugar 8000 of the 21,000 acres of new land brought under cultivation by means of irrigation from the Akosombo dam currently under construction on the Volta. A site has been chosen for the sugar factory which should start operations probably in 1965.

* * *

Irrigation pipe manufacture in Hawaii[11].—Hawaiian Commercial & Sugar Co. has started the manufacture of tin irrigation pipes, called spiles. Production averages around 1300 a day by three employees. The company anticipates considerable savings by manufacturing its own spiles. While plastic spiles, now being used, have to be removed from the fields before harvesting the tin spiles need not. The cost of removing a plastic spile amounts to almost as much as manufacturing a tin spile, the company estimates.

* * *

Czechoslovakian sugar factory for Syria[12].—A contract for the construction of a sugar factory in the West Syrian district of Al-Ghab has been signed by the Czech agency Technoexport. The factory, which is to be completed by mid-1966, will have an annual production capacity of 25,000 tons of white sugar.

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[1] C. Czarnikow Ltd., *Sugar Review*, 1964, (657), 76.
[2] C. Czarnikow Ltd., *Sugar Review*, 1964, (658), 81.
[3] C. Czarnikow Ltd., *Sugar Review*, 1964, (659), 85.
[4] *Fortnightly Review* (Bank of London & S. America Ltd.), 1964, **29**, 218.
[5] F. O. Licht, *International Sugar Rpt.*, 1964, **96**, (9), 17.
[6] C. Czarnikow Ltd., *Sugar Review*, 1964, (658), 81.
[7] *Sugar y Azúcar*, 1964, **59**, (5), 83.
[8] C. Czarnikow Ltd., *Sugar Review*, 1964, (665), 108.
[9] *Rev. Agric. Sucr.* (Maurice), 1964, **43**, 3.
[10] *Sucr. Belge*, 1964, **83**, 427.
[11] *Sugar y Azúcar*, 1964, **59**, (6), 70.
[12] F. O. Licht, *International Sugar Rpt.*, 1964, **96**, (18), 9.

BREVITIES

Sugar factory construction in the U.S.S.R.[1].—Three large sugar factories are under construction in the Russian Federal Republic. Half of the Republic's sugar is currently produced by 38 factories already in operation in the area. A total of 260 million tons of beet is scheduled for delivery for processing there this year according to the Russo-British Chamber of Commerce.

* * *

New sugar factory for Italy[2].—The Societá Italzucker has been founded in Sassari on the island of Sardinia. This company, the capital of which is to be increased in time from one million to 1000 million lire, plans to build an automatically operated sugar factory near Sassari. At the same time, another company, the "Sardo Bieto Sugar" has been founded to foster sugar beet cultivation on Sardinia as well as to secure the supply of raw material to the sugar factory.

* * *

Roumania crop results, 1963/64[3].—According to latest official reports from Roumania, sugar production in 1963/64 amounted to 286,315 metric tons of white sugar, i.e. 318,120 tons raw value. The 1963/64 beet area amounted to 178,500 hectares from which 2,289,200 tons of beets were harvested. Thus a beet yield of 12·87 tons per hectare was reached, sugar extraction was 13·85% raw value, and the sugar yield per hectare was only 1·78 tons, considerably lower than during the preceeding three years. In the previous campaign, sugar production was 312,085 metric tons, raw value, beet yield was 14·08 tons/hectare and the sugar extraction reached 14·32%, raw value, while the sugar yield per hectare was 2·02 tons.

Stock Exchange Quotations

CLOSING MIDDLE

London Stocks (*at 17th August* 1964)	s d
Anglo-Ceylon (5s)	8/–
Antigua Sugar Factory (£1)	12/6
Booker Bros. (10s)	18/7½
British Sugar Corp. Ltd. (£1)	32/6
Caroni Ord. (2s)	3/7½
Caroni 6% Cum. Pref. (£1)	15/6
Demerara Co. (Holdings) Ltd.	5/3
Distillers Co. Ltd. (10s units)	26/4½
Gledhow Chaka's Kraal (R1)	26/–
Hulett & Sons (R1)	38/9
Jamaica Sugar Estates Ltd. (5s units)	5/4½
Leach's Argentine (10s units)	20/–
Manbré & Garton Ltd. (10s)	36/6
Reynolds Bros. (R1)	23/–
St. Kitts (London) Ltd. (£1)	20/–
Sena Sugar Estates Ltd. (10s)	7/6
Tate & Lyle Ltd. (£1)	37/1½
Trinidad Sugar (5s stock units)	3/3
United Molasses (10s stock units)	33/1½
West Indies Sugar Co. Ltd. (£1)	15/6

CLOSING MIDDLE

New York Stocks (*at 15th August* 1964)	$
American Crystal ($5)	17¾
Amer. Sugar Ref. Co. ($12.50)	18¾
Central Aguirre ($5)	25¾
North American Ind. ($10)	35¾
Great Western Sugar Co.	14½
South P.R. Sugar Co.	32¾
United Fruit Co.	21½

Mexico sugar exports[4].—In 1963, Mexico exported 377,415 metric tons, raw value, of which 343,596 tons went to the U.S.A., 22,348 tons to Italy and 11,471 tons to Israel. In 1962, 350,199 tons were exported, all to the U.S.A. Both years' figures were much less than that of 1961, when 611,550 tons were exported, all but 980 (sent to Chile) going to the U.S.A.

* * *

Craig factory for Iran[5].—A contract valued at £3,250,000 for a sugar factory in Iran has been won by A. F. Craig & Co. Ltd., of Paisley. The contract is to be completed in 18 months and the factory will handle 1600 tons of beet per day for production of white sugar. It will be sited at Meshed.

* * *

Sugar factory for Arizona[6].—Spreckels Sugar Company has announced that it will build a $20 million beet sugar factory in Salt River Valley, Arizona, some 21 miles south-east of Phoenix. The new factory will have a capacity of 1,000,000 pounds of sugar per day and will draw beets from 20,000 acres of farmland. The Chandler factory will have an initial capacity of 3800 tons of beet per day, and will start operating in 1967[7].

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The late R. C. L. Bosworth.—We regret to report the death on the 24th March of Prof. R. C. L. Bosworth, Head of the Dept. of Physical Chemistry at the University of New South Wales. He was educated at the University of Adelaide and at Trinity College, Cambridge, returning to Australia in 1938 where he was appointed research chemist to the Colonial Sugar Refining Co. Ltd. In 1948 he became manager of the Company's research department, remaining there until 1957 when he returned to academic life. His work for the C.S.R. Co. was reported in papers presented to the I.S.S.C.T. and Queensland Society and has been noted in this Journal, while he was also the author of three books.

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The Tanganyika Planting Co. Ltd. 1963/64 report.—The Tanganyika Planting Co. Ltd.'s 1963/64 season recently ended with a total production of 30,670 long tons of sugar, 12·5% higher than the 1962/63 outturn, and setting a new record. Average cane yield was 85 tons/acre compared with 75 tons in 1962/63. The D.d.S. cane diffuser, worth more than £100,000, was put into commission at the beginning of the season and worked satisfactorily throughout, making it possible to extract 2% more sugar from the cane than would otherwise have been the case. A substantial investment programme for 1964/65 includes modern vacuum pans, automatic centrifugals, etc. and will increase the capacity of the factory which, it is estimated, will reach 35,000 tons of sugar per year by 1966.

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Lobo sugar company difficulties.—Voluntary petitions have been filed in the Federal Court for court approval of a plan under which the obligations of Olavarria & Co. Inc. and Galban Lobo Company Ltd., both controlled by Mr. Julio Lobo, would be postponed while they continue in business[8]. The two companies handled more than 20% of all U.S. sugar imports in 1963 but have suffered substantial losses as a result of the break in sugar prices earlier this year. A comment by Dr. M. Palyi on the matter[9] discounts the suggestion that the difficulties arise from the fact that much of the Lobo resources are held "in escrow" by the Castro Government in Cuba. He attributes them to the purchasing of raw sugar for forward delivery at the turn of the year for a price of 11 cents a pound, without hedging by forward sales. Now that the price of sugar arriving in the U.S. or on its way to fulfil these contracts is only 4½ cents an estimated 6 million dollar loss has resulted, combined with a further deficit of $1,800,000 between the two companies.

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[1] C. Czarnikow Ltd., *Sugar Review*, 1964, (666), 112.
[2] F. O. Licht, *International Sugar Rpt.*, 1964, **96**, (17), 11.
[3] F. O. Licht, *International Sugar Rpt.*, 1964, **96**, (17), 11.
[4] *Lamborn*, 1964, **42**, 111.
[5] *The Times*, 4th August 1964.
[6] B. W. Dyer, *Sugar Summary*, 10th July 1964.
[7] *Willett & Gray*, 1964, **88**, 292.
[8] *The Times*, 24th July, 1964.
[9] *Chicago Tribune*, 11th August 1964.