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NOTES AND COMMENTS

British Sugar Corporation Limited Annual Report, 1963/64.

Following the severe frosts in the early part of 1963, spring work on the land was delayed and farmers had to sow their sugar beet a little later than is desirable for maximum yields, but this was in part offset by reasonably good growing conditions in England, a virtual absence of disease in the crop, and an unusually dry autumn which favoured sugar production and eased harvesting. In Scotland, however, weather conditions were particularly bad. A wet, cold spring, followed by adverse growing conditions and an abnormally wet November, limited crop development and created unusually difficult harvesting conditions. For these reasons both yield and sugar content of beet delivered to Cupar factory were substantially below the average of the English factories.

The total quantity of beet delivered was 5,253,723 tons, representing 12·86 tons per acre, with an average sugar content of 16·67%, the highest since 1959. This represents 42·88 cwt of sugar per acre, compared with 40·74 cwt in 1962 from a beet yield of 12·99 tons per acre.

The output in terms of white sugar was 738,945 tons, equal to 36·17 cwt per crop acre. The production of molassed dried pulp, including 107,283 tons in the form of nuts, was 435,402 tons. The total amount of molasses produced was 233,824 tons.

In 1963, although 60,000 tons less beet was processed, the output of sugar was 51,500 tons greater than in 1962. At the same time, many growers benefited from the higher sugar content by the revised differential payment of 10s per 1% sugar variation from 16% which operated for the first time in the 1963 contract.

The higher fibre content of the beet resulted in an increase in dried pulp of 3,500 tons.

Wider adoption of modern methods and techniques continued the progress made during recent years to reduce the amount of handwork required for crop production and delivery. Eighty-five per cent of the total crop was sown with processed seed compared with 80% in 1962. The use of precision drills showed an increase from 47% to 54% of the total acreage planted and chemical weed control applied at the time of drilling was used on 15% of the acreage compared with 11% in 1962. These techniques result in a substantial saving in singling time and are a necessary prelude to the complete mechanization of the spring work.

Eighty-eight per cent of the crop was harvested mechanically. Harvesting was virtually complete by the second week of December and the undelivered portion of the crop made safe from frosts in roadside clamps for subsequent delivery to the factories.

Cleaner-loaders are a recent development and were used last season on approximately 30% of beet delivered. As cleaners reduce the amount of soil delivered with beet by approximately one half, a considerable saving results from their use, both in haulage costs to the grower and to the Corporation in soil disposal.

The maximum acreage permitted to be sown in 1964 was reviewed by H.M. Government in November 1963, and increased by 20,750 acres to 435,350 acres. Approval for continuation of this increase for 1965 has now been received.

Main replacement and renewal items consisted of new beet reception plant at Cantley; continuous extraction plant at Ipswich; conversion to continuous filtration at Felsted, Kidderminster and York, and a new automatic lime kiln at Brigg. These have contributed considerably to further savings of seasonal labour. At Cantley a large modern sugar packeting plant and four 10,000-ton sugar silos were erected which have increased bulk storage capacity to 150,000 tons of white sugar. Further silos are being erected this year at King's Lynn and Cupar. At York a granular carbon juice purification plant was installed for the production of sugar for specialized industrial purposes.

The factories worked at a high average capacity with few breakdowns, which reflects a very good standard of maintenance. The campaign production of white sugar was increased considerably by the profitable remelting in white factories of about 45,000 tons of sugar produced in the Corporation's raw factories.

By changing over entirely to pulp nuts at King's Lynn production was increased, and more high-efficiency pulp presses were installed, resulting in an improvement in sugar extraction and reduced fuel usage for pulp drying.

During the past year the electronic beet costing system was extended to four further factories, making fourteen factories equipped in this namner. Electronic saccharimeters which automatically determine the sugar content of the beet sample have now been installed in the tarehouse laboratories at all factories.

The existing data processing equipment, having virtually reached its full capacity, was replaced during the year by an electronic computer which was installed to take over the beet accounting system and the analyses of agricultural statistics, maintenance costing, and sugar despatches. During the past campaign the computer has enabled the Data Processing Department to give improved service both to growers and factories.

The delivered cost of refined sugar produced from the 1963/64 sugar beet crop was 59s. 6¾d per cwt (last year 59s 11¼d). The comparable cost of raw sugar of 97·5° polarization from the same crop was 50s 11¼d per cwt (last year 51s 9½d). The reduced cost of sugar production in 1963/64 can be attributed largely to increased income from by-products.

At the Extraordinary General Meeting of the Corporation held on the 25th March the proposed changes in its relationship with the Government[1] were approved.

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Anglo-Irish Sugar Agreement[2].

A review has been held of the operation of the Anglo-Irish Sugar Agreement under which the United Kingdom each year buys 10,000 tons of refined beet sugar produced in the Irish Republic.

Mr. CHRISTOPHER SOAMES, Minister of Agriculture, announcing this in a Commons written reply, stated that it is proposed, in the light of changes in the market situation, to increase the price in the current and subsequent years to the equivalent of the price paid under the Commonwealth Sugar Agreement.

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Australian Sugar Producers' Association Ltd. 1964 Annual Report[3].

Including the New South Wales crop, 12,120,473 tons of cane were crushed in the 1963 season, as compared with 12,735,993 tons in 1962; the areas harvested were 417,776 and 401,555 acres respectively. Australia's raw sugar production (including N.S.W. output) in the 1963 season was about 1,727,000 tons 94 net titre, as compared with the record level of 1,849,261 tons in the 1962 season.

Pre-season crop estimates by individual mill areas proved too optimistic, as the Director of the Bureau of Sugar Experiment Stations suggested at the time. Late growth was not so pronounced as in 1962 and there was heavy arrowing of crops and some frost damage was experienced. The season saw a further advance in both mechanical harvesting of cane and in mechanical loading of hand-cut cane; it is worth noting, however, that only a minor proportion of the crop—about 26%—is now loaded by hand. Mechanical harvesting accounts for 12·7% of the total, 61·4% being manually cut and mechanically loaded.

While the past year was remarkable in itself, the most significant events of 1963 were the decisions taken to lift export volumes much higher in the future. The immediate export targets are 1·4 million tons from the 1964 season and 1·6M tons from that of 1965. To achieve these exports and also provide for Australian consumers requires raw sugar production to the level of 2,000,000 tons in 1964 and 2,200,000 tons in 1965. Subsequent production targets of 2,350,000 tons in 1968 and 2,500,000 tons in 1970 have also been recommended by the Committee of Inquiry appointed by the Queensland Government last year.

The attempt to produce 2 million tons of raw sugar from existing cane lands in the 1964 season required very special efforts on the part of cane growers during the past year including heavy expenditure on fertilizer and the adoption of unusual agricultural practices. To achieve the further increase aimed at in 1965 required the clearing and preparation of additional lands for cane cultivation. Sugar mills have had to embark on very costly programmes to increase milling and transport facilities to handle the much larger crops that will be offering in 1964 and 1965.

Sizeable additions to storage facilities at ports are essential to match the new levels of sugar output and about £A4,750,000 will be needed for new bulk terminal extensions. With the completion of a bulk terminal at Cairns during 1964, all Australian raw sugar will be despatched from mills in bulk form. During 1963 despatch in sacks continued at only two mills shipping through Cairns. The opening of the Cairns terminal will complete the changeover to bulk handing that commenced with the opening of the Mackay terminal in 1957. Additions to storage capacity (including the Cairns terminal) will bring the total of 1964 to 830,000 actual tons, while a further 380,000 tons are to be added for the 1965 season.

The Association's President, Mr. W. A. BRAND, C.B.E., announced that he would not be a candidate for re-election to the Executive for 1964. Mr. BRAND was a member of the Executive since 1940 and has been President since 1943. Mr. E. M. BENNETT, M.B.E., was appointed unopposed to the Presidency of the Association.

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U.K. sugar surcharge.

The Sugar Board raised the surcharge on sugar with effect from the 14th July to 2½d from 2d per lb (to 23s 4d from 18s 8d per cwt). The charge, made in order to bring the Sugar Board's trading position more into line with the current level of world prices, permitted an increase of about 4s 8d per cwt in the ex-refinery price of sugar.

[1] *I.S.J.*, 1964, **66**, 102.
[2] C. Czarnikow Ltd., *Sugar Review*, 1964, (665), 108.
[3] *Australian Sugar J.*, 1964, **55**, 847-878.

PLANT NEMATODES

PLANT nematodes, or eelworms, may be troublesome pests with many crop plants, including both sugar cane and sugar beet. A good deal of study and experimental work has been devoted to them in many different countries during the last two decades and much more is now known about them and possible means of control. Nevertheless it is conceded that a great deal still remains to be learned. Some kinds or species of nematode are very widely distributed, occurring in several continents, and this applies to some of those nematodes that attack sugar cane, such as *Meloidogyne arenaria* and *M. javanica*, which are active on sugar cane in countries as far apart as Queensland, Natal and Taiwan (Formosa). There are at least five different nematodes known to attack sugar cane in Taiwan. In Natal attention has recently been drawn to cane loss caused by nematodes, including *Meloidogyne javanica*, and certain weeds there are suspected of being responsible for building up populations of nematodes that attack sugar cane.

An interesting general account of plant nematodes and their control has recently been given by L. S. CATHIE[1]. This author points out that nematodes may be found in a variety of soil types but it is the light well-drained soils that provide the most suitable conditions for their development, provided of course that suitable host plants are present. In a warm environment, as in the tropics and under conditions suited to sugar cane, nematodes may be active throughout the year, but in temperate climates activity ceases in the winter. Consequently in the tropics and subtropics nematodes may present even more of a problem than they do in temperate countries. Damage is likely to be most severe where monoculture is practised and this of course applies to sugar cane in most cane-growing areas.

The progress made in recent years in controlling nematodes has been largely due to the introduction of more effective chemical nematocides. These have made control an economical proposition over a wider range of crops than was previously the case. Nevertheless in comparison with insect control the control of nematodes is relatively unadvanced.

Where crops have a low cash value, rotation of crops or fallowing may be the only economical means of control. Some troublesome nematodes find only certain plants suitable as host plants. If none of these plants are present they connot thrive or survive. The sugar beet nematode, *Heterodera schachtii*, offers a good example. It has relatively few host or potential host plants and has been successfully controlled in Great Britain by rotation, in fact crop rotation is compulsory by law on land known to be infected with it, beet being kept off the land for 4–5 years. Some nematodes, such as those commonly attacking the potato, may remain dormant in the soil, in the absence of host plants, for many years.

Heat treatment is successful in controlling nematodes under some conditions, a good example being the hot water treatment now applied to certain classes of horticultural planting material, such as *Narcissus* and *Lilium* bulbs, and Chrysanthemum stools. Care has to be exercised in temperature control to ensure that the temperature is high enough to destroy the nematodes but at the same time not sufficiently high to injure the plant material. Steam sterilization of the soil, before sowing or planting, is widely used in glass houses and seed beds to destroy a complex of soil-borne diseases and pests, including nematodes.

Nematodes, like other forms of life, may be attacked, in a state of nature, by other organisms, including fungi and bacteria. Attempts to make use of these in controlling harmful nematodes have not so far met with much success. Most interest has been centred in certain species of nematode-trapping fungi which thrive well under high organic matter conditions but which are rarely found in field soils at depths where the bulk of the plant nematodes live[2]. It has also been found that some plants, e.g. African Marigold (*Tagetes erecta*), have a destructive effect on certain nematodes in the soil in which they are grown. This is believed to be due to a root excretion, which happens to be abnoxious or harmful to nematodes.

It is the chemical methods of control that show most promise against nematodes at the present time. These are being used to an increasing extent. It was as long ago as 1871 that a German plant pathologist (KUHN) applied carbon bisulphide to the soil in an attempt to control sugar beet nematode. Although giving some success the method was uneconomical. Later chloropicrin (tear gas) was used against nematodes, especially against pineapple root-knot nematodes in Hawaii. Later methyl bromide was used, mainly for potting soil and seed-beds. Being highly volatile, these materials require fumigation chambers or gas tight covers and this restricts their usefulness in some spheres.

Present day nematocides, which may be highly complex chemically, fall into two main categories, (1) those that are phytotoxic or harmful to plants as well as to nematodes and (2) those that are not phytotoxic and do not injure the growing plant or its roots. Naturally those nematocides in the first category may only be used while the land is fallow or between harvesting and replanting. They may not be used with permanent or tree crops, such as many plantation crops, some of which are severely attacked by nematodes. DBCP (1,2-dibromo-3-chloropropane) is a nematocide that may be successfully used to treat many growing plants. Among tropical crops where chemical means are now used to combat nematodes are bananas, citrus, pineapples, tobacco and cotton.

[1] *World Crops*, 1963, **15**, 460–463.

[2] C. L. DUDDINGTON: *I.S.J.*, 1957, **59**, 319.

In considering the future the author (L. S. CATHIE) concludes with the following remarks: "There is still scope for a great deal of improvement in nematode control methods. A field which offers promise is the development of resistant varieties of plants, and research is at present being actively pursued by plant breeders. This research is of necessity long term, however, and alternative methods of control will probably always be required. Of these chemical control offers most scope for development.

"There is a need for a cheap nematocide which can be profitably used to treat low- to medium-value crops. There is also need for a product which can be safely used to treat growing plants and which will, unlike DBCP, be effective over a wide range of temperature, or, better still, be independent of temperature. In addition, it is highly desirable to have a chemical which can be applied much more easily and cheaply than those currently in use. In an effort to find such chemicals an increasing volume of research is being devoted to chemical control of nematodes and, while there is no evidence yet of a major breakthrough, the chances of this occurring increase daily."

F.N.H.

MECHANICAL HARVESTING OF SUGAR CANE BY GROUP OWNERSHIP

A DESCRIPTION has recently been given[1] of a method whereby eight cane growers in Queensland pooled resources in order to purchase two mechanical harvesters for use on their farms.

The eight farmers—in the Cairns district, supplying Hambledon mill—formed themselves into a company. The two harvesters (Massey-Ferguson 515's) were worked in tandem and were moved from one farm to another on a strict rotational basis, but with apportioned cutting tonnages.

Prior to the purchase of the two machines a system of apportioned cutting was worked out by one member of the group. The system provided for the harvesting of a progressively increasing percentage of each man's crop as the machines moved from one property to the next. This was to ensure that the eight growers would have a similar proportion of their crop delivered to the mill during the mid-season period of relatively higher sugar content of the cane.

The eight partners of the enterprise drew lots to establish the harvesting sequence and operations began with the cutting of 25% of the cane on Grower No. 1's farm. This was followed by 32% of the estimated tonnage on the second property and so on. Progressive 'increments of approximately 7% meant that the first cut for Grower No. 8 represented 75% of his total tonnage. Then the machines moved back to Grower No. 1 to harvest the remaining 75% of his cane, after which the original sequence was maintained until all crops had been cut. The total harvested of the eight growers was 16,306 tons, averaging rather more than 2000 tons each.

The company had a management committee of three and one of the group was appointed field manager. The harvesting crew included two harvester operators, two trailer drivers, four cleaners and the field manager. Two men went ahead of the machines removing extraneous matter, suckers and weeds.

At a meeting on joint ownership of cane harvesters at Hambledon the following points were made, for the benefit of prospective owners: A partnership agreement should be drawn up by a solicitor and the company name registered. Ownership in proportion to primary peaks is recommended. Comprehensive insurance on the equipment is necessary. Working capital of £300 to £500 in a current account should be initially subscribed *pro rata* by members as part of their overall capital investment. The company's charge for harvesting should be sufficient to pay all expenses and avoid contributing additional funds to the bank. A Chairman and Secretary should be appointed at the first meeting. Minutes should be kept. Decisions normally are made on the basis of one vote to each farm, with any member having the right to demand a poll. In the latter case voting is in accordance with capital subscribed. Because of the additional wear and tear on machinery there should be an additional harvesting charge for over-peak cane.

It was also pointed out there should be an additional charge for difficult cane, which slows down harvest schedules. This could be mutually agreed upon. Generally each partner is responsible for his own extraneous matter penalties. Payment for the labour of each member should be based on hours worked. The company would have to furnish an income tax return but would not be liable to tax. Individual members' proportions of profit or loss would be recorded on their private returns.

F.N.H.

[1] *Australian Sugar J.*, 1963, **55**, 659–660.

A MODEL CANE FARM IN NATAL

A description of what might be termed a model cane farm in the midlands of Natal (a few miles from Sevenoaks), has appeared in the *South African Sugar Journal*[1]. This farm, "Spes Bona", run by Mr. and Mrs. HENRY HALFORD, has recently been declared the winner of a cup competition. Some of the points put forward about Mr. HALFORD's methods of sugar cane farming may interest cane growers in other parts of the world who grow cane under sub-tropical rather than tropical conditions. The farm is at an altitude of 3500 feet (latitude about 29–30°) and has an average rainfall of 35 inches. Frost may occur in winter in low lying areas. Climatic conditions might therefore be regarded as almost marginal for sugar cane. Nevertheless, good cane yields are obtained. The soils are of the deep, sandy loam type but notably deficient in phosphates like most South African soils.

Yields

The owner of "Spes Bona" has 350 acres under cane. Last season his fields yielded 46 tons of cane per acre averaging 13·55% sucrose. He also has other farming interests, notably black wattle (for tannin extract), eucalyptus, pine and poplar for timber, citrus and New Zealand hemp (*Phormium tenax*). Sugar cane and black wattle or timber are a happy combination on the farm in that cane grows best in situations with a northern aspect while the trees prefer a southern aspect. This combination also renders possible a stable labour force throughout the year, because the stripping of wattle bark or timber work and cane cutting are at different seasons.

Trash Burning

What may be of interest to some is that the owner burns all his cane before harvesting. Experiments conducted by himself have shown that burning the trash is essential if cane is to be grown successfully on his high altitude farm. A trash blanket tends to keep the soil temperature at a low level, retarding ratooning and shortening the growing season.

Subsoiling

Mr. HALFORD "is a great believer in subsoiling and this is practised on all his cane fields. Fertilizer is applied in the furrow at planting and this is followed with a top dressing when the cane is 6 inches high. Immediately after top-dressing the fields are rotavated. This serves to work in the fertilizer and to kill weeds at germination point. Mr. HALFORD prefers rotavators for all the cultivation work in his cane fields. Depending on the length of line, 8–10 acres of cane can be cultivated by a single rotavator in one day, as against 2½ acres per day by a mule-drawn cultivator. Furthermore, rotavating can be done in practically all weather conditions, which is not the case when mules are used. The total cost of rotavating is 30 cents per acre (100 cents = 10 shillings). Another advantage of using a rotavator, says Mr. HALFORD, is the fact that it leaves the soil well levelled off; there is no furrowing which may contribute to soil erosion in heavy storms. He prefers a water-cooled diesel-powered machine. The lack of ventilation in well developed cane fields may prove troublesome to air-cooled models, and with petrol powered models there is always a possibility of causing cane fires through sparking".

Fertilizers

In order to prove to himself that he is following the best fertilizer practices the owner lays down his own fertilizer experiment for each block of cane planted. He contends that a farmer cannot learn too much about the use of fertilizer and that it is easy for him to spend much money on unprofitable practices because he has not availed himself of existing information and advice. He states "As a progressive farmer I consider it my duty towards my farming enterprise to study the findings of experts and to supplement these as far as possible with my own experiments. This is the only way of getting to know the real capabilities and needs of my fields". On account of the acidity of the soil at "Spes Bona" he uses citric-soluble instead of water-soluble phosphate and is gradually changing over from superphosphates to basic slag".

Labour Force

A labour force of about 80 is maintained on the farm throughout the year. "Labourers and their families are housed in small villages which are scattered over the farm. This decentralization of labour has two main advantages. Firstly, it ensures a lookout system for fires and speedy action if a fire should occur, because labour is always close at hand; and secondly, the situation of a labour village near the eastern border of the farm has created a buffer between the farm and the adjacent native reserve. Labourers are supplied with a balanced ration and in addition, gardening land is made available to them, although this is very seldom used."

Cane Varieties

The cane varieties grown at "Spes Bona" are N:Co 382 in the lower lying areas because of its strong frost-resisting qualities, N:Co 293 because of its known high yield of sucrose per acre, and N:Co 376. "Mr. HALFORD is also experimenting with N:Co 310, which is generally considered to be a coastal cane. He has planted a few acres with this variety and it is growing vigorously. Cane experts who have visited his farm estimate the yield from this field at about 80 tons per acre".

Value of detailed bookkeeping

Mr. HALFORD is a keen advocate of detailed and careful bookkeeping and contends that the modern farmer should spend much time in his office planning,

[1] 1963, **47**, 304–307.

studying and analysing. His own records are kept up-to-date daily and by merely glancing at the summary of costs he can supply the following information for any individual cane field on the farm—yield per acre, profit per acre per annum, cost to grow per ton of cane, cost to exploit a ton of cane, and the net profit.

F.N.H.

AGRICULTURAL ABSTRACTS

The biological control of moth borer (*Diatraea saccharalis*) with special reference to *Lixophaga diatraeae*. L. W. VAN WHERVIN. *Ministry of Agriculture, Lands and Fisheries, Barbados, Bull.*, 1963, (35), 14 pp.—A full account is given of past attempts in this field and of the renewed attempts that have been made in recent years. The pros and cons of mass rearing of the parasite and liberation are discussed. Barbados is considered to be environmentally resistant to *Lixophaga* but investigations are being continued, notably with different ecological strains of the parasite.

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Sugar cane in Tanganyika. ANON. *Ann. Rpt. Dept. Agric. Tanganyika*, 1961, (I), 9.—Development of the Kilombero Sugar Company's estate has proceeded rapidly. Some 1700 acres of commercial cane have been planted and an overhead irrigation system installed. The cane was growing well and high yields expected; the factory was taking shape rapidly.

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Comparison of four methods for isolating nematodes from soil samples. A. AYALA, J. ROMÁN and A. C. TARJAN. *J. Agric.* (Univ. Puerto Rico), 1963, **47**, 219–225.—The four methods used on both sandy and clay soils were: the sugar flotation technique (SF), Oostenbrink flotation apparatus 111 (OFA), the modified Oostenbrink method (FCES) and the sieving petri-dish method (SPD). No one method was completely satisfactory for all types of soils. SF was generally superior for sandy soils and the other three methods with clay soils.

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The topping of sugar cane. S. ALERS ALERS and G. SAMUELS. *J. Agric.* (Univ. Puerto Rico), 1963, **47**, 257–264.—It is pointed out that the advent of mechanical harvesting focuses increased attention on height of topping. The many different factors that may be concerned are outlined. Tests were carried out on six different varieties in humid and irrigated areas of Puerto Rico at ages 12, 18, 20, and 22 months. It was concluded that, in general, low topping was more profitable than the high topping now in commercial use in Puerto Rico.

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Effect of ratoon stunting disease on emergence of tassels of sugar cane in Hawaiian acid solution. P. H. DUNCKELMAN. *Sugar y Azúcar*, 1963, **58**, (10), 31–32, 45.—In breeding work, making use of cut flowering stalks in acid solution, the presence of RSD may lead to plugging of the fibrovascular bundles, thereby slowing down or shutting off the steady uptake of solution, with an adverse effect on tasselling or seed maturation. This study shows how greatly this effect is likely to vary with different varieties.

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The quest for clean beets. A. ARMER. *Spreckels Sugar Beet Bull.*, 1963, **27**, 44–45.—This is the fourth of a series of articles dealing with the many factors contributing to the delivery of clean sugar beet. It is freely illustrated and traces the development of devices for removing soil adhering to the beets as well as trash or clods.

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Sugar cane depth-of-planting experiments in Alabama and Mississippi. D. M. BROADHEAD, I. E. STOKES and K. C. FREEMAN. *Agron. J.*, 1963, **55**, 419–420; through *Biol. Abs.*, 1964, **45**, 1385.—Trials were carried out with one variety at Brewton and two varieties at Meridian and Poplarville, depth of planting being 1½, 3, and 4½ inches. Results on yield and Brix was not significant. Optimum planting depth was considered to be 3 in at Brewton and Meridian and 4½ in at Poplarville. Lodging through winds of hurricane force decreased with depth of planting at Meridian.

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The importance of magnesium in the nutrition of sugar beet. M. SIMON and N. ROUSSEL. *Pub. Tech. Inst. Belge pour Amél. Betterave*, 1963, **31**, 87–97.—The importance of adequate magnesium in the soil is stressed and symptoms of magnesium deficiency described. Results of leaf analyses for magnesium are given, also yields of normal beets compared with those suffering from magnesium deficiency.

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Destruction of couch grass or twitch on sugar beet land. L. DETROUX. *Pub. Tech. Inst. Belge pour Amél. Betterave*, 1963, **31**, 143–145.—Notes are given on the destruction of *Agropyrum repens* with "TCA", "Dalapon," "DBA" (sodium dichlorobutyrate) and "Anitrol".

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Production of sugar beet seed from over-wintered stecklings. V. JENSEN. *Zucker*, 1963, **16**, 596–600. From observations in Denmark over many years, it is considered important that the stecklings or young plants should reach a certain size before winter, viz. 6–8 mm or the thickness of a pencil. On average 30% are destroyed by freezing. During the last 30 years only 2 winters have caused total loss. Average seed yield is higher for wintered fields than for replanted fields.

On the relationship between water and sugar cane yield in Hawaii. J. H. CHANG *et al. Agron. J.*, 1963, **55**, 450–453; through *Biol. Abs.*, 1964, **45**, 1385.—A general equation is derived to express the fraction of actual to potential yield as a function of the fraction of actual to potential evapotranspiration. Estimated yields differed from actual yields by 7%.

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Supplemental irrigation by sprinkling increases Delta sugar beet yields. E. F. NOURSE *et al. California Agric.*, 1963, **17**, (7), 2–3; through *Biol. Abs.*, 1964, **45**, 1385.—The use of sprinklers to supplement the usual method of sub-irrigation, which maintains a water level 3–4 feet below the soil surface increased October-harvested production of sugar beet by 8·4 tons per acre over the control with 16 tons.

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Soil moisture tension, sugar cane stalk elongation and irrigation interval control. F. E. ROBINSON. *Agron. J.*, 1963, **55**, 481–484; through *Biol. Abs.*, 1964, **45**, 1385.—Gypsum blocks placed at a depth of 12 in in the centre of a cane furrow gave useful estimates of the effect of soil moisture tension upon cane elongation. The elongation rate of cane stalks declines as soil moisture tension approaches 2 bars at 12-in depth. It is recommended that irrigation be applied before soil moisture tension reaches 2 bars at this depth.

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Assessing the utility of pan evaporation for controlling irrigation of sugar cane in Hawaii. F. E. ROBINSON *et al. Agron. J.*, 1963, **55**, 444–446; through *Biol. Abs.*, 1964, **45**, 1385.—Length of stalk proved a reliable indicator of the effect of soil moisture deficiency on yield. Differences in yield with six irrigation treatments reflected the variation in stalk length. The 0·85 treatment produced optimum yields under the conditions involved.

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The sugar cane seedling programme at Houma, Louisiana. R. D. BREAUX and H. P. FANGUY. *Sugar Bull.*, 1964, **42**, 122–127.—The breeding activities of the U.S. Sugar Cane Field Station at Louisiana are outlined. The spread of a new strain of mosaic among resistant commercial varieties in Louisiana is likely to impose a still further strain on the plant breeder. Some forms of *Saccharum spontaneum*, wild ancestors of present Louisiana commercial varieties, once believed immune to mosaic, have been attacked by strains of the virus now present in Louisiana and Florida.

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Fertilizer recommendations for sugar cane in Louisiana for 1964. ANON. *Sugar Bull.*, **1964**, **42**, 119.—A guide is given in regard to quantities of N–P–K fertilizers to use on the different sugar cane soils in Louisiana.

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Recommendations for the control of Johnson grass. E. R. STAMPER and D. T. LOUPE. *Sugar Bull.*, 1964, **42**, 118–121.—Approved cultural and chemical methods for the control of Johnson grass (*Sorghum halepense*) and Johnson grass seedlings in Lousiana are outlined, fallow ploughing (six or more times) being still necessary to control Johnson grass plants and rhizomes. The best methods of using various chemical herbicides are indicated.

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1963 crop a new record. L. L. LAUDEN. *Sugar Bull.*, 1964, **42**, 92.—The record crop in Louisiana (760,000 tons) is considered to be due to a number of factors but primarily to better cane farming on the part of Louisiana growers.

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Don't destroy stubble early. L. L. LAUDEN. *Sugar Bull.*, 1964, **42**, 104.—Reasons are given why, under Louisiana conditions, old rootstocks of sugar cane should not be ploughed out too early in the season, a main reason being that it should be a reserve in case other areas fail.

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Excessive borer damage in Queensland. ANON. *Producers' Rev.*, 1964, **54**, (1), 35.—Severe borer or grub damage in Bundaberg cane fields is considered to be due to the resistance of the cane having been weakened by unfavourable growing conditions and to the carrying of crops into the third and fourth ratoon in an effort to boost production for 1964. This also favours soldier fly.

* * *

Campaign against sugar cane borers. ANON. *Producers' Rev.*, 1964, **54**, (1), 5.—In a campaign to control cane borer or cane grub, growers in the Isis area of Queensland have treated a substantial acreage with BHC dust. The 40% BHC dust is favoured, instead of "Lindane", by most growers because of its ability to control soldier fly infestation as well as cane grub.

* * *

The progress of sugar cane breeding in the Philippines. A. R. APACIBLE. *Sugar News*, 1963, **39**, 788–792. The steady increase in yield per hectare that has taken place in the Philippines during the last two decades or so, owing to improved varieties, is referred to, and illustrated in tabular form. The breeding programme is discussed and the need stressed for the production of new varieties suited to individual districts or areas.

The labour problem in sugar plantations. P. L. B. ALONZO. *Sugar News*, 1963, **39**, 782–785.—Present labour difficulties in the Philippines, particularly in Negros Occidental, are dealt with as far as the agrarian worker is concerned.

* * *

Some practical aspects of soldier fly control in the Bundaberg District. R. B. MOLLER. *Cane Growers' Quarterly Bull.*, 1964, **27**, 108.—The following insecticides are recommended, to be applied broadcast to fallow land and worked in by discing and ploughing: crude 20% BHC dust at the rate of 308 lb per acre or crude 40% BHC dust at the rate of 154 lb per acre or less; or else 25% "Dieldrin" emulsifiable concentrate at the rate of approximately 2½ gal per acre.

* * *

Sugar cane mosaic and Sorghum. ANON. *Cane Growers' Quarterly Bull.*, 1964, **27**, 96.—A more-than-normal infection of mosaic in the Booyal section of the Isis Mill area of Queensland is considered to be due, in part, to infection from nearby wild *Sorghum*, transmitted by corn aphids. Need for the destruction of wild *Sorghum* and Johnson grass is stressed.

* * *

What to plant. *Cane Growers' Quarterly Bull.*, 1964, **27**, 75–107.— A series of five articles constitutes a good planting guide to sugar cane varieties in Australia. They are: What to plant in the far north—Mossman to Tully, by J. H. BUZACOTT and C. A. REHBEIN; Cane varieties for planting in the Lower Burdekin area, by C. A. CHRISTIE; What to plant in the Central District—Proserpine to Plane Creek, by C. G. STORY; Varieties to plant in Maryborough, Moreton and Rocky Point areas, by C. L. TOOHEY; and What varieties to plant in the Victoria and Macknade Mill areas, by O. W. D. MYATT and I. J. V. STEWART. Details of varieties, with many illustrations, are given, and a list of varieties approved for planting in different districts in 1964.

* * *

Weed control in sugar beets by combinations of thiolcarbamate herbicides. E. F. SULLIVAN, R. L. ABRAMS and R. R. WOOD. *Weeds*, 1963, **11**, (4), 258–260; through *Biol. Abs.*, 1964, **45**, 1722.—Effective control of *Chenopodium album* (lamb's quarters), *Amaranthus retroflexus* (pigweed), *Setaria* spp. and other weed species, without undue injury to sugar beet seedlings, was obtained. PEBC + DATC also gave control of *Avena fatua* (wild oats). None of the herbicides tested effectively controlled *Kochia scoparia*.

* * *

Control of plant diseases by crop rotation. E. A. CURL, *Botanical Review*, 1963, **29**, (4), 413–479.—General principles of plant disease control are first discussed followed by control of specific diseases, viz. diseases caused by fungi, bacteria, nematodes, virus diseases, and parasitic seed plants. Sugar beet nematodes and their control by rotation or fallowing are referred to. A bibliography of 415 entries is included.

Studies on the chemical quality of sugar beet in the warmer regions of Japan. H. YUNOMURA and S. KANO. *Proc. Crop Science Society of Japan*, 1963, **32**, 109–120.—This consists of three separate papers (in Japanese with English summaries) viz.—1. "Changes in the content of sugar and harmful constituents in the sugar beet plant in summer." 2. "On the chemical quality of the sugar beet crown sown in summer." 3. "On the chemical changes of the sugar beet crown during the harvest dates."

* * *

Agricultural research in the sugar industry. T. G. CLEASBY. *South African J. Science*, 1964, **60**, 42–48. This is a general account on popular lines of agricultural research at present in progress with sugar cane in Natal and Zululand, with special emphasis on the problem of breeding and producing new varieties suited to Natal conditions.

* * *

New drainage techniques cut costs. ANON. *J. Agric. South Australia*, 1964, **67**, 202–206.—Modern techniques are cutting the cost of tile drainage. The main savings are due to fast new trenching machines (illustrated) which cut narrow trenches designed to take plastic drainage pipes which may be wrapped at the joints with glass fibre pipe wrapping to exclude silt or fine sand.

* * *

Technical and economic problems of sugar factory waste water sprinkling. B. MAZUR. *Gaz. Cukr.*, 1963, **71**, 222–224.—Two schemes are described for the spraying of factory waste water onto fields and details and illustrations are given of the sprinkler systems used.

* * *

Sugar and molasses in the control of nematode. O. FALANGHE and N. DIAS NETTO. *Biológico* (Sao Paulo), 1962, **28**, 196–198; through *S.I.A.*, 1963, **25**, Abs. 840.—The sugar and cane molasses were applied to soil infected with *Meloidogyne incognita* at a rate of 5 kg and 8·1 kg respectively per sq.m. to a depth of 15 cm. The molasses was diluted 1:1 for application. Complete elimination of the nematode was obtained after the molasses treatment; the sugar was somewhat less effective, but both were more effective than a standard nematocide. The treatment is possible only on a small scale owing to the large doses required.

* * *

Plastic irrigation siphon tubes. ANON. *Producers' Review*, 1964, **54**, (2), 5.—Tests with plastic siphon tubes for furrow irrigation in Western Australia showed that the smooth bore, semi-rigid black polyethylene siphon tube was highly satisfactory. Tube sizes favoured were 1¼ in for furrows up to 16 chains long, 1½ in for furrows up to 20 chains and 2 in for longer furrows. Small diameter siphons reach a point where increase in head gives little extra flow.

SINGLE PASS *vs.* RECIRCULATION IN EVAPORATORS

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

PART II

The same principle, but with a central downtake in the calandria, is shown in Fig. 7 where both inlet and outlet for juice are located in the bottom of the vessel. Incoming juice is distributed by a perforated ring pipe in the bottom space of the body. Good access to this bottom space is achieved through a centrally arranged bottom cover.

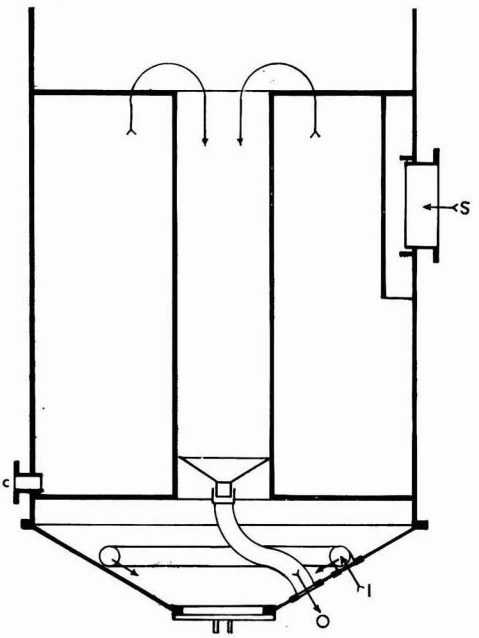


Fig. 7. Stork evaporator—single-pass flow

In the writer's experience, single-pass evaporators have surpassed recirculating designs in performance. It must nevertheless be remembered that after conversion of recirculating apparatus, the results obtainable are subject to the characteristics of the existing design and often juice distribution and other details must be altered as well. But increases in evaporation of 5% or more have been achieved, as the writer's experience confirms.

Evaporator Design with Alternative Juice Flow

The design shown in Fig. 8 has been developed during the past ten years. Juice is charged by a bent pipe through the interior of the calandria into the middle of the circular bottom space. The juice flow is deflected by the dished bottom cover and uniform juice distribution may be expected. Concentrated juice gushes out of the tubes and flows over the upper tube sheet towards the annular channel around the calandria. By closing the valve *R*, the apparatus functions according to the single-pass system, whereas by opening this valve more or less recirculation will take place.

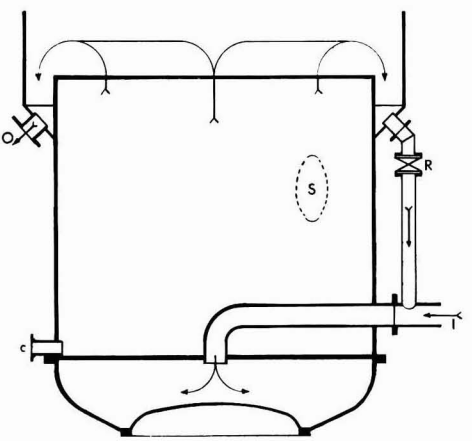


Fig. 8. Robert-Buckau Wolf evaporator—alternative juice flow

The consequent higher entrance velocity into the lower end of the tubes, through the increased volume of mixed virgin and concentrated juice, has practically no effect so far as increasing evaporation is concerned. In addition, with recirculation, the mixed juice has a higher Brix and heat transmission is consequently reduced. Having its temperature lowered through flashing, the recirculating juice also cools the incoming juice.

Seen from these viewpoints, recirculation cannot be expected to further evaporation.

Evaporator with Positive Recirculation

A compound evaporator of this type is shown in Fig. 9, the juice passing first through the right-hand section I of the calandria, which performs a single-pass evaporation. The bottom space is provided with a partition to separate the two sections of the apparatus. Above the calandria a dividing shield is arranged for this purpose; the height *h*, for practical reasons, cannot completely prevent the juice from splashing from one section to the other.

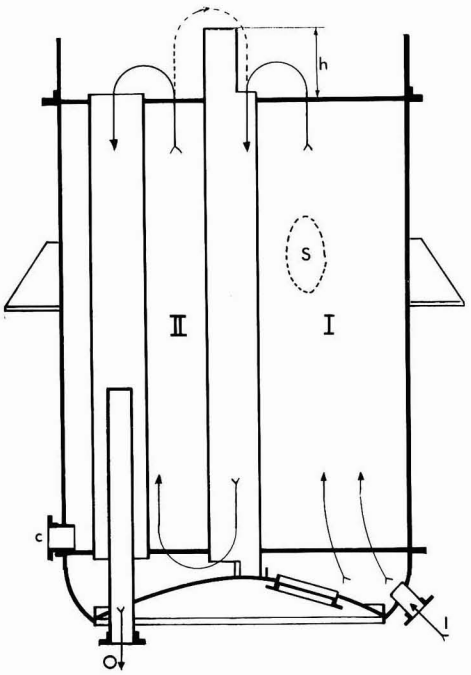


Fig. 9. BMA evaporator—positive recirculation

Having passed through section I, the juice falls down through the central downtake and is guided towards section II which, curiously enough, is of the problematic circulation type with its own downtake arranged to one side. By means of a stand pipe inside the downtake of section II a fixed juice level is maintained, but it is not known if this level is that required for maximum evaporation.

In order to obtain a two-fold evaporation it will be evident that the heating surface of section II must be about equal to that of section I. When an evaporator of this type is compared with one having an undivided calandria of the same heating surface as those of sections I and II combined, the entrance velocity of juice into the tubes of the former is twice the entrance velocity in the latter type; it is nevertheless still extremely low so that it cannot have any worthwhile effect on heat transmission.

The promoter of this type of evaporator was Dr. CLAASSEN and, used as the first body of a multiple effect, it obtained an increase of about 10% in the heat transmission coefficient, the single-pass section undoubtedly having contributed to this result.

In such an installation, not only does the juice pass from one section to the other but also the vapour produced in the first section. By helmeting the top of the first section, including the downtake, the vapour space of the first section may be separated from the second. To achieve a higher entrance velocity for the mixture in the second section the hydrostatic pressure in the latter must be overcome, which required a higher vapour pressure in section I than in section II.

Juice level regulation in single-pass and recirculating evaporators

Juice level regulation in the oldest multiple-effect evaporators is achieved simply by manipulating the valves in the juice pipes between successive bodies; optimum regulation in this way is hardly to be expected. The tenacity of many designers and operators to cling to the recirculating evaporator may be due to the fact that the juice level can be regulated by an overflow at the juice outlet, as in Fig. 9. Usually the overflow is connected by a syphon to the subsequent body so as to avoid blowing through.

Because the standpipe maintains a fixed level, other designers have provided a telescoping sleeve around the standpipe so that the height of the overflow can be adjusted from outside the apparatus. Nowadays, float-operated valves are employed, either directly energized or by means of a foreign agent such as compressed air through a pilot-operated servo-mechanism.

The question arises as to the level at which juice should be kept when leaving the evaporator. CLAASSEN, KERR and other investigators have found that a juice level of 25–35% of the tube length will give the most favourable evaporation figures.

Obviously the quantity of water evaporated per unit of heating area will depend not only on the efficiency of the design of the evaporator but also on the difference between the temperature of the heating steam or vapour and the boiling temperature of the juice. The effect of the higher viscosity through increased Brix has been mentioned above.

With the single-pass evaporator, the juice level cannot be regulated by such devices as used in the recirculating type and the question arises as to whether there can be juice level regulation with such a system. It is now a well-established fact that both systems, recirculation and single-pass, depend on the phenomenon that juice ejected from the heating tubes must flow to the downtake. Practical observations, which have been more closely investigated by KIRSCHBAUM[2], reveal that more juice is ejected when it reaches a higher level, and less when the level is lower. This phenomenon can be explained in terms of the increased hydrostatic head of juice inside the tube at the higher juice level; this causes the juice temperature to be increased, which results in an increased eruptive force. Furthermore the juice has to be lifted over a shorter distance at the higher level. It follows that, with the single-pass system, the juice volume in the evaporator is *automatically* adjusted to the most favourable level, which will result in optimum evaporation.

[2] *Forschung Ingenieurs Wesen*, 1935, (375).

MOLASSES FORMATION

By Prof. P. M. SILIN
(Institute of Technology of the Food Industry, Moscow)

Paper presented to the 12th General Assembly of the C.I.T.S., 1963

STANDARD MOLASSES

A VERY large number of industrial molasses samples have been analysed to find the cause of sugar losses in molasses. However, this work has resulted only in approximate and indefinite conclusions. Consequently, numerous contradictory theories have been advanced on molasses formation: the ash (rendement) theory, that of "noxious" N (ANDRLIK) and the K-Na or alkali theory (DEDEK).

The uncertainty of these conclusions is understandable; analyses of molasses from various factories cannot be compared directly, for the molasses are obtained under quite different conditions, and these variable process factors mask the influence of the non-sugars composition.

To make the molasses comparable, they must all be reduced to certain "standard" conditions by complementary crystallization. These "standard" conditions must approach the normal factory operating conditions.

Usually, the crystals are separated from the molasses by centrifuging at 40°C and the separated molasses is saturated with sugar, since the supersaturation is usually removed by a drop of hot water or by heating through 5–7°C.

The concentration of the separated molasses (r % dry solids as determined refractometrically in a drop of undiluted molasses) is of great importance. It governs the molasses purity and, hence, the sugar loss. One hundred kg of molasses contains r kg of dry solids and $(100 - r)$ kg of water, in which is dissolved $(100 - r)\,Ho\,\alpha'$ kg of sugar (where $Ho = 2{\cdot}37$ is the sugar solubility in 1 kg of water at 40°C and α' is the saturation coefficient showing how the molasses non-sugars increases the solubility of the sugar). The purity of the molasses q is given by

$$q = \frac{100\,(100 - r)\,Ho\,\alpha'}{r} \qquad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

We see from this formula that to reduce q we must increase r. But this increase is limited by the considerable increase in viscosity which ensues. From observations of factory operations, it has been found that the highest practical viscosity for spinning is 44 poises, corresponding to a dry solids concentration r of 82% at a spinning temperature of 40°C.

Molasses "standard" purity

On the basis of these data, we have suggested considering as "standard" a molasses of 82% dry solids concentration which is saturated with sugar at 40°C. The purity of this standard molasses is the "standard" purity[1,2,3]. If the factory molasses purity is higher than the standard purity of the same molasses, the crystallization is considered inadequate. On the other hand, if the purity of the factory molasses is lower than the standard purity, the work is perfect.

A laboratory method has been developed for determining the standard molasses purity by supplementary crystallization of sugar from factory molasses held at a concentration $r = 82\%$ at 40°C for 2–3 days in the presence of excess sugar crystals[4].

For verification of this "norm" of molasses purity, we obtained 17 molasses samples from various regions (RSFSR, Ukraine, Kazakhstan, Germany and France).

We analysed these samples and determined the factory molasses purity and the standard purity. In two cases the difference between these purities was 4·1 and 3·7; the work of the factories was obviously inadequate. In the other 15 cases, the difference ranged from +1·5 to —0·8, i.e. within close limits, and averaged +0·4. This signified that the molasses purity "norm" is justified.

The method of controlling molasses through the standard purity has already been used in Soviet sugar factories for 10 years.

Variants and new proposals

One defect in control by means of standard purity lies in the long period (2–3 days) of crystallization needed to obtain saturated molasses. I. E. SADOVYI[5] has suggested saturating molasses by dissolving sugar instead of crystallizing, since dissolution proceeds much more quickly than crystallization. The molasses ($r = 82$) is saturated with sugar at 55°C (molasses of 82% dry solids is undersaturated at this temperature). This requires only 9 hr, after which the saturated molasses is analysed to determine its saturation coefficient (α'). This coefficient remains the same at other temperatures (i.e. as at 40°C) if the non-sugars: water ratio is constant[6], and this permits calculation of the % sugar and the standard purity q_n at 40°C.

In Poland, K. WAGNEROWSKI, D. DABROWSKA and C. DABROWSKI[7] determine the standard purity in as

[1] SILIN: *Bull. Assoc. Chim. Sucr.* (Paris), 1935, (7–8), 516.
[2] idem: Voprosy tekhnologii sakharistykh veshchestv (Problems in the technology of sugar substances). (Moscow, Pishchepromizdat.) 1950, pp. 182–216.
[3] idem: Tekhnologiya sveklosakharnogo i rafinadnogo proizvodstva (Technology of beet sugar and refined sugar production). (Moscow.) 1958, pp. 430–450.
[4] SILIN & SILINA: Khimicheskii kontrol' sveklosakharnogo proizvodstva (Chemical control of beet sugar production). 1960, p. 222.
[5] *Sakhar. Prom.*, 1960, (10), 19–20; *I.S.J.*, 1961, **63**, 91.
[6] SILIN: *Sakhar. Prom.*, 1952, (3), 19.
[7] *Gaz. Cukr.*, 1960, **62**, 68–70; *I.S.J.*, 1960, **62**, 225.

little as two hours by saturating the molasses with sugar at 80°C and mixing very rapidly. Finally, recently K. P. ZAKHAROV[8] has proposed saturating the molasses also by dissolution, but in a special vibrating cell (2000–3000 vibrations per min at an amplitude of 0·75 mm). He has obtained a saturated molasses in one hour.

These intensified methods are valuable since they make control by standard purity very convenient for the factory.

To ensure more accurate determination of standard purity, the molasses viscosity must be taken into consideration and the standard concentration (r_n) altered slightly in conformity with this. The viscometer should become an indispensable piece of sugar factory equipment. We have already developed a more accurate method[9,10].

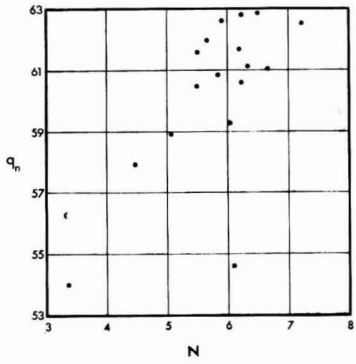
RÔLE OF NON-SUGARS IN MOLASSES FORMATION

Rôle of separate groups of non-sugars in molasses formation

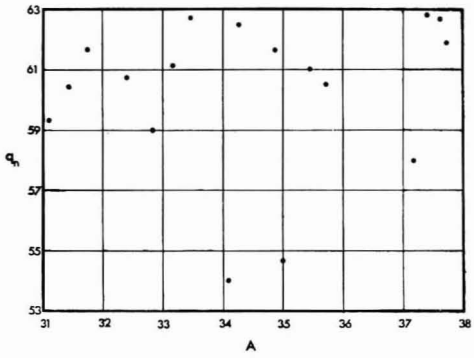
Attempts have been made to find the substance that is responsible for molasses formation and sugar losses in molasses (ash, noxious N, K and Na). We can check these hypotheses by comparing standard molasses.

As well as determining their standard purity, we also analysed the 17 different molasses mentioned above for N, sulphate ash and CaO. We calculated[2], as a percentage of the non-sugars, the N content, the total sulphate ash and the sulphate ash of potassium and sodium (taking this alkaline ash as the difference between the total sulphate ash and $CaSO_4$).

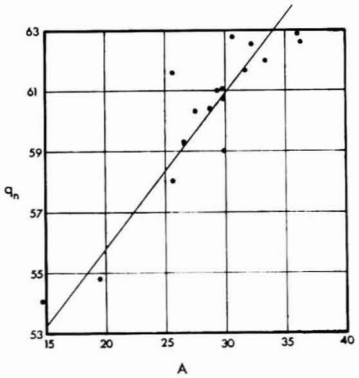
Figs. 1, 2 and 3 demonstrate our attempts to discover the relationship between molasses standard purity and the % noxious N, the total ash and the



alkaline ash in the molasses non-sugars. There is no clear relationship between purity and nitrogen content or total ash (Figs. 1 and 2), but there is an obvious relationship with the alkaline ash content



(Fig. 3), which may be expressed by a graph, although the points are somewhat scattered. All this shows that the alkali theory of molasses formation (DEDEK)



corresponds more to actual conditions than any of the others, but also that it is slightly inaccurate. It is obvious that other non-sugars play some part in molasses formation as well as the alkalis.

The rôle of separate non-sugars in molasses formation

The molasses standard purity method permits determination of the melassigenic coefficient (m) for each separate non-sugar, i.e. the value which shows how much sugar (in kg) is retained by 1 kg of non-sugar in the molasses. Z. A. SILINA[11,12] was the first to determine the melassigenic coefficient m for 25 various non-sugars.

[8] Issledovánie putei umen'sheniya soderzhaniya sakhara v melasse (Investigation of means of reducing molasses sugar content). (Dissertation, Krasnodar Institute of the Food Industry.) 1961. *See also Sakhar. Prom.*, 1962, (10), 12–14; *I.S.J.*, 1963, **65**, 123.

[9] SILIN & SILINA: *Sakhar. Prom.*, 1953, (7), 21.

[10] SILIN: *Sakhar. Prom.*, 1957, (12), 39; *I.S.J.*, 1958, **60**, 338.

[11] *Trudy Leningrad. Tekhnol. Inst. Pishch. Prom.*, 1949, **1**, 22.

[12] SILIN: Tekhnologiya sveklosakharnogo i rafinadnogo proizvodstva. (Moscow.) 1958, p. 452.

So that values of m should have significance for sugar factories, Z. A. SILINA determined them under factory molasses conditions. She took any molasses, determined its standard purity q_o and its melassigenic coefficient ($m_o = \frac{q_o}{100 - q_o}$); she then added a non-sugar under test (for example NaCl) to this molasses. Let the quantity of this added non-sugar be n % of the total non-sugars in the mixed molasses. SILINA again determined the standard purity q_1 and the coefficient m_1 of the mixed molasses.

One hundred kg of the non-sugars in this molasses retain 100 m_1 kg of sugar in the molasses. This 100 kg of non-sugars includes n kg of added non-sugar (NaCl) which retains nm kg of sugar (m is the unknown melassigenic coefficient of the added sugar), and $100 - n$ kg of the original non-sugars in our molasses, which retain $(100 - n)m_o$ kg of sugar. It follows[13] that $100\ m_1 = nm + (100 - n)m_o$ and

$$m = m_o - \frac{100}{n}(m_1 - m_o) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Each determination of m was repeated 3 times with different molasses. The results obtained were close, indicating that the quality of the original molasses does not affect the determined value of m.

The mean results of the determination of m are given in Table I.

Table I

Melassigenic coefficient m of non-sugars

Non-sugar	*m*	*Non-sugar*	*m*
NaOH	4·61	K products of invert sugar decomposition	0·70
K_2CO_3	3·38	$CaCl_2$	0·56
Na_2CO_3	2·88	Na products of invert sugar decomposition	0·55
K acetate	2·85	$NaNO_3$	0·42
Na acetate	2·71	Invert sugar	0·19
NaCl	2·58	Ca glutamate	0·18
KCl	2·48	Ca tyrosinate	0·11
Betaine	1·03	Ca lactate	—0·14
K lactate	1·02	Ca acetate	—0·55
K glutamate	0·99	Ca products of invert sugar decomposition	—0·66
KNO_3	0·96	$Ca(NO_3)_2$	—1·14
Na glutamate	0·93		
K tyrosinate	0·90		
Na lactate	0·81		

The results lead to the following conclusions:

(1) It is impossible to attribute molasses formation to any single non-sugar because each non-sugar has its melassigenic coefficient.

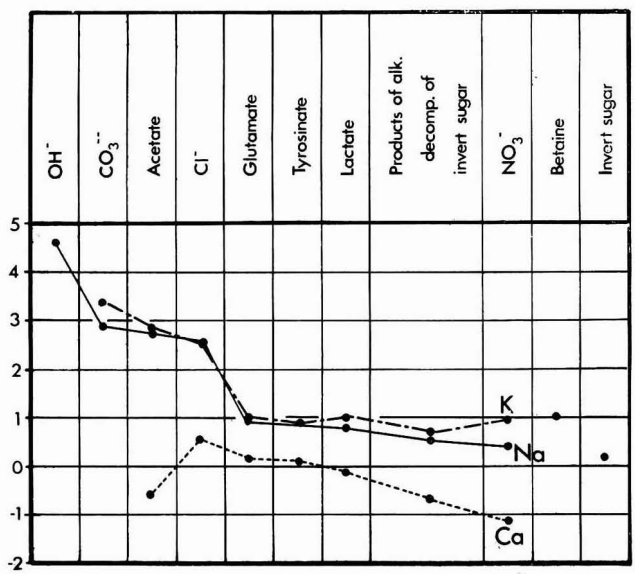
(2) It is impossible to consider cations alone melassigenic, because anions also exert marked influence. For example, the same Na cation, combined with different anions, gives widely differing values of m:

NaOH: $m = 4{\cdot}61$; NaCl: $m = 2{\cdot}58$;
$NaNO_3$: $m = 0{\cdot}42$

Table II

Melassigenic coefficient m for cations and anions of various non-sugars

Cations	*Anions* OH^-	CO_3^{--}	CH_3COO^-	Cl^-	*glutamate*	*tyrosinate*	*lactate*	*invert sugar decomposition products*	NO_3^-
K^+	—	3·38	2·85	2·48	0·99	0·90	1·02	0·70	0·96
Na^+	4·61	2·88	2·71	2·58	0·93	—	0·81	0·55	0·42
Ca^{++}	—	—	—0·55	0·56	0·18	0·11	—0·14	—0·66	—1·14



(3) "Noxious" nitrogen is only slightly melassigenic; glutamic acid and tyrosine salts and betaine have values on m in the range of only 0·11–1·03. This corresponds to sugar factory experience: beets rich in noxious nitrogen give low purity molasses.

(4) The K cation is the most melassigenic; Na is a little less so and the least melassigenic is Ca^{++} (Table II and Fig. 4). These facts are in agreement with the theory of DEDEK concerning the special role of alkalis in molasses formation; but this theory is only approximate.

(5) The melassigenic nature of anions in decreasing order is:

$OH^- > CO_3^{--} > CH_3COO^- > Cl^-$ > glutamate > tyrosinate > lactate > acid products of the lime decomposition of invert sugar > NO_3^-. The alkalis

[13] That the effect is additive was recently affirmed by Prof. F. SCHNEIDER *et al.*: *Zucker*, 1961, **14**, 234–237, 307–311; *I.S.J.*, 1961, **63**, 351.

(NaOH, KOH) are the most melassigenic evidently because they form saccharates. For the same reason, the carbonates are highly melassigenic: when hydrolysed they release the alkali that forms the saccharate.

Industrial practice has empirically confirmed the adverse effect of alkaline reaction on sugar crystallization: syrup is made almost neutral by sulphitation before crystallization.

(6) The non-sugars can be separated into three groups:

(a) very melassigenic ($m > 2{\cdot}4$): alkali carbonates, K and Na acetates and chlorides;

(b) moderately melassigenic ($m = 1{\cdot}1$–$0{\cdot}8$): betaine, other K and Na salts, amino acids and lactic acid;

(c) slightly melassigenic ($m < 0{\cdot}8$): invert sugar, salts of alkaline decomposition products of invert sugar, all Ca salts and $NaNO_3$.

Some non-sugars in the last group are even negatively melassigenic (some Ca salts). Obviously, these ions are very hydrophilic, bind part of the water and salt-out the sugar. But in binding the water, these negative non-sugars increase the viscosity of the molasses which requires a reduction in concentration during spinning, i.e. some of the sugar crystals are dissolved. Thus, when we take viscosity into consideration, we find that the Ca salts are also positively melassigenic. It should be noted that fresh beet do not yield these Ca salts in the molasses, because they contain only very little invert sugar.

(7) In general, every endeavour must be made by selective breeding to obtain beet which in the sugar factory give high purity juice containing only a minimum of non-sugars, since all non-sugars are more or less melassigenic.

BRITISH SUGAR CORPORATION LTD.

17th Technical Conference

THE 17th Technical Conference of the British Sugar Corporation Ltd. was held during the 3rd—5th June 1964, at Selsdon Park, Sanderstead, Surrey.

Delegates gathered during the 2nd June from Austria, Belgium, Canada, Denmark, France, Germany, Holland, Ireland, Sweden and Switzerland, while representatives of Tate & Lyle Ltd., Westburn Sugar Refinery Ltd. and this Journal were also present as were the Works Managers and many other technical personnel of the B.S.C. The Chief Technical Officer of the Corporation, J. CAMPBELL MACDONALD, O.B.E., took the chair and opened the Conference on the following morning, reviewing the results of the past campaign in Britain when, he explained, the average slice of 51,331 tons of beet was below the industry's potential as a result of the low crop. Some 47,000 tons of sugar were refined during the normal campaign time in the West of England factories because of the lack of beets.

Labour requirements and total losses had again been reduced although unknown losses were higher: a development under study by the Corporation.

The first technical paper was then presented by Dr. CARRUTHERS, Director of Research of the Corporation, describing investigations by his Department into the fate of formaldehyde added to the beet diffusers. Contrary to many workers' belief, the pulp reacted with very little, if any, formaldehyde which entered the juice to be destroyed during liming with the formation of acid products.

Fig. 1. Lord Champion and Mr. Macdonald with guests of the Corporation.

Dr. M. L. A. VERHAART then presented a paper on the variation of certain non-sugars between thick juice and white sugar, with especial reference to the saponins, foaming number of the white sugar, and the effect of several carbon adsorbents.

After lunch, Mr. R. TAYLOR, an Executive Director of the Corporation described the crop prospects for the coming season. Increased acreage for 1964/65 presaged an early start and a long campaign. Representatives of the Canadian and Continental industries then gave an account of their past crops and prospects for the 1964/65 campaign.

Prof. H. HIRSCHMÜLLER, Director of the Institut für Zuckerindustrie in Berlin, presented a section of a film prepared at the Institute, illustrating the physical effects on heating dry sucrose and the chemical changes taking place. He then described the latest work carried out in his laboratories on these decomposition reactions and their products.

The General Secretary of the Comité Européen des Fabricants de Sucre, M. H. de VEYRAC, then gave a detailed account of the proposals recently put forward by the European Economic Community Commission to the Council of Ministers of the Community. These have been described briefly in this Journal[1], but were explained more fully by M. de VEYRAC, who provided answers to a number of questioners.

In the evening was held a Conference Dinner for delegates, presided over by the Conference Chairman. After the loyal toast, guests were welcomed and toasted in a speech by the Rt. Hon. Lord CHAMPION, J.P., one of the Directors of the Corporation. A gracious response was made by M. J. PAUL of France, who made a number of references to WILLIAM SHAKESPEARE, the 400th Anniversary of whose birth is celebrated this year.

Herr O. VON LOESSL, of Germany, then made a speech in which he referred to the impending retirement of Mr. MACDONALD, whose idea had been the Technical Conferences such as that in progress. Many guests had been present at nearly all of these and all had benefited from the full and frank exchanges of information which had taken place. On behalf of the guests he presented Mr. MACDONALD with a handsome silver tray (Fig. 2) inscribed with a dedication to Mr. MACDONALD on the under-surface and with the names of the contributors to the gift on the top surface.

Fig. 2

Mr. M. J. COSTELLO, on behalf of the Irish Sugar Co. Ltd., then presented Mr. MACDONALD with a wrist-watch (Fig. 3) with which is also to go an Irish carpet for the home in Ireland to which he and Mrs. MACDONALD will retire in October. Mr. MACDONALD expressed his thanks for these gifts in a speech which was warmly applauded, and after which the assembly was entertained by a number of B.S.C. staff, notably J. K. ALDRIDGE, A. M. D. ATTERSON and I. L. SLATOPOLSKY.

Fig. 3

The following morning, Mr. J. F. T. OLDFIELD presented another paper from the B.S.C. Research Dept. dealing with pulp losses by combustion in dryers, using the analysis of potassium and calcium as the means of estimating them. There followed an account by Mr. T. RODGERS of the latest studies in the series concerned with improvement of white sugar quality with the aid of forced circulation in vacuum pans.

After lunch, some of the participants in the Conference played off a golf tournament on the course in the hotel grounds, while others visited the Royal Horticultural Society's gardens at Wisley, both expeditions, however, being marred by rain.

The following morning was devoted to papers concerned with carbon adsorption of colour and non-sugars, the first an account of a small plant operated at York factory which was illustrated with a number of slides by R. M. J. WITHERS. The second paper, by F. M. CHAPMAN of Tate & Lyle Ltd., gave a comparison of the "slugging" system (a batch system with short starts) with the large cistern type of batch system where the starts are much less frequent; he concluded that static cisterns in series

[1] *I.S.J.*, 1964, **66**, 137.

are a much better system than the other.

Diagrams and data of heat usage and power in the British sugar factories were provided by P. SCOTT, Combustion Engineer of the Corporation, but these were not discussed, and the Chairman then closed the Conference.

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 I

IT has been known for some time that the colouring substances entering sugar juices and syrups have different chemical and physico-chemical characteristics. They have differing effects on the increase in colour of sugar crystallized out of the solution. However, as long as the colour of solutions is determined exclusively with a Stammer colorimeter, the problem cannot be clearly defined. Experiments in artificial preparation of colouring substances and study of their effect on the degree of colour of a sucrose crystal can only be of theoretical significance.

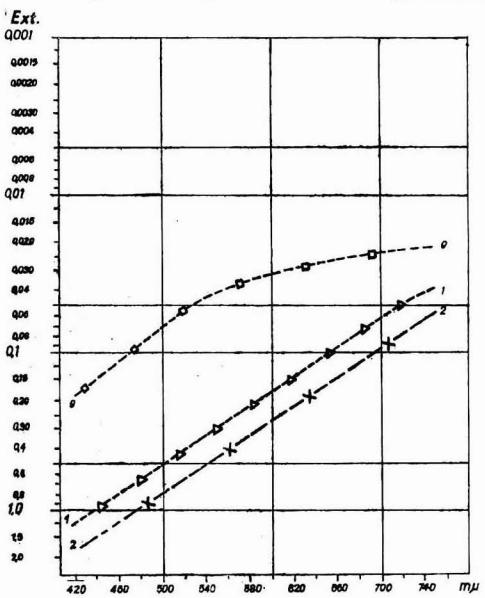


Fig. 1. Thick juice extinction.

1. Normal thick juice. 2. Caramelized thick juice. 9. Decolorized thick juice.

In this work attempts were made to determine and describe the effect of colour matter present in sugar juices and syrups on the colour of the sucrose crystal. Factory juices and intermediate products as well as juices obtained under laboratory conditions by standard methods of juice extraction and purification were crystallized.

The crystallization method was precisely defined so that the process conditions were identical with each test. Particular attention was paid to uniform graining and to the crystallization temperature as well as massecuite circulation, which has a decisive effect on the process rate. During graining as well as during crystal growth the supersaturation was maintained in the neighbourhood of 1·1. The grain was set by full seeding. About 30 min elapsed before the solution was brought to 1·1 supersaturation, whereat a reduced pressure of 250–270 mm Hg was

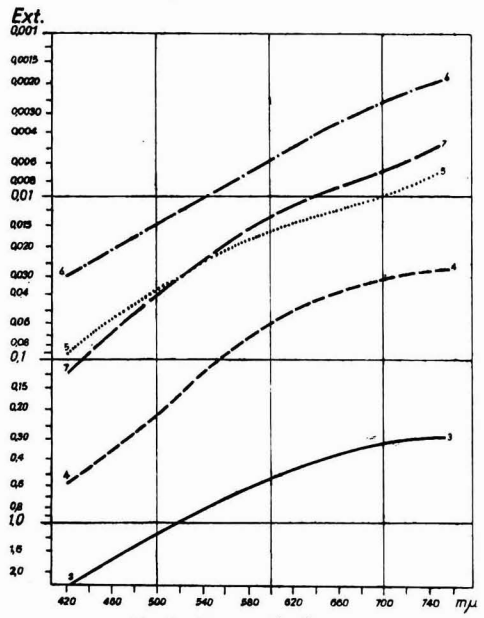


Fig. 2. Syrup extinction.

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.

used. The crystallization process was continued until a third of the total sucrose had crystallized out of the solution. The sugar crystals were separated from the mother liquor by spinning in a centrifuge at 2900 r.p.m. for 6 min, hot water and steam being used for affination.

The colouring matter was then separated from sugar juices and syrups. Active carbon and decolorizing resin were used as adsorbents.

The colouring matter adsorbed by the active carbon was desorbed with various solvents. Pyridine proved to be the best. Juices, syrups, remelt liquors and molasses were subjected to thorough decolorization with active carbon. The carbon was then extracted many times with an azeotropic mixture of pyridine and water after controlled rinsing with water and drying. The pyridine was distilled from the resultant colour solution under reduced pressure while the required amount of water was added gradually. This procedure permitted an aqueous solution of colouring matter to be obtained from the individual sugar products.

The colouring matter desorbed from the decolorizing resins was carefully extracted with a concentrated ammonium carbonate solution. After the ammonium carbonate had been driven off, colouring matter was obtained from the extract also in the form of aqueous solution.

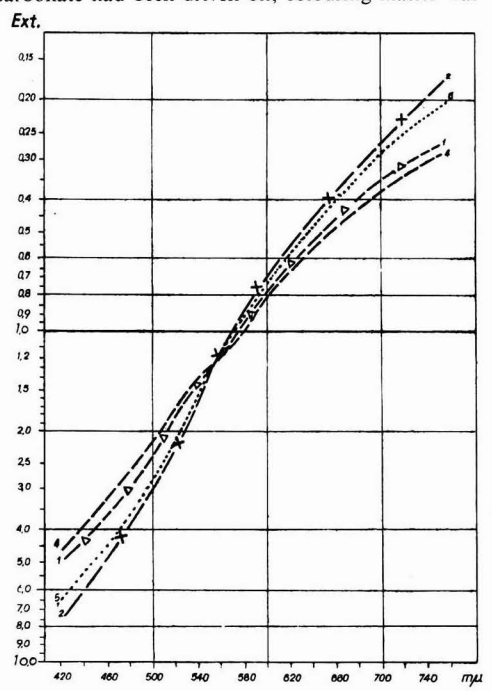


Fig. 3. Extinction of colouring matter obtained from syrups and juices

1. Normal thick juice. 2. Caramelized thick juice. 4. Remelt liquor decolorized with active carbon. 5. Remelt liquor decolorized with resin.

The methods described permitted separation of more than 95% of the colouring matter and proved suitable for further studies.

The tests were conducted on normal thick juice, dark thick juice (of higher caramel content), intermediate strike remelt liquor and molasses. Extinction curves for these solutions are given in Figs. 1 and 2. Log (extinction) is plotted on the ordinate axis and the wavelength of light at which the solutions were examined was plotted on the abscissae axis. Solutions with a dry solids content of 50 g/100 ml were used in all determinations. The solutions were neutral (pH 7).

The solutions were decolorized with active carbon using the batch, counter-current or column method, or with a decolorizing resin. The adsorbed colouring substances were extracted from the adsorbents as described above and were prepared in the form of aqueous solutions. Fig. 3 shows extinction curves of the aqueous solutions of the

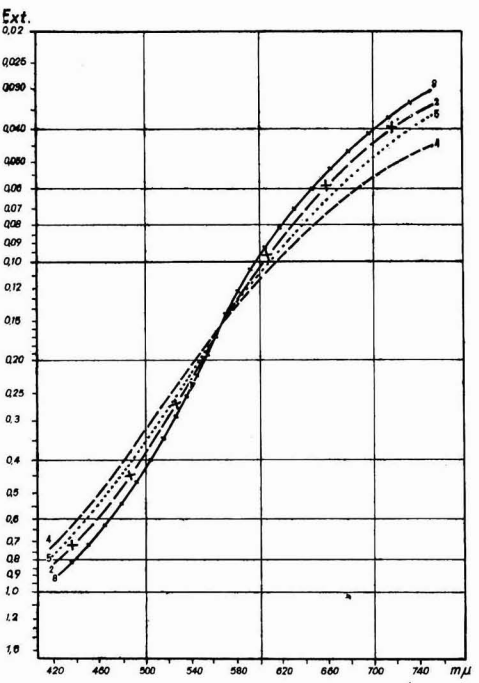


Fig. 4. Extinction of colouring matter in sucrose solutions. The colouring matter was extracted with active carbon and decolorizing resins.

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.

colouring substances at such concentrations that all the extinction curves can be shown in one graph.

The colouring substances obtained were introduced into aqueous solutions of sucrose. Sufficient of the colouring matter solutions were added that the prepared solutions gave the same extinction at a light wavelength of 560 mμ. The results obtained are given in Fig. 4.

As the graph shows, active carbon removes slightly different colouring substances than the decolorizing resin. The colouring substances obtained from different products gave different extinction curves.

It was difficult to effect complete decolorization of dark remelt liquors or molasses with active carbon using the batch method. Tests were therefore carried out on decolorizing remelt liquors and molasses by the column method. The height of the active carbon bed (column) was 1 m. In this way, we succeeded in obtaining a completely colourless clear liquor, the purity rising from 97·7 to 98·3. Using the same method to decolorize the molasses gave a purity rise of about 4 units.

To get the best decolorization of sugar products, the so-called combined method was also applied; this was developed at the Dept. of Sugar and Food Technology of Lodz Institute of Technology.

The method consists in subjecting sugar solutions to a pre-decolorization with carbon that has been used once already. Then this same solution is decolorized with decolorizing resin and finally once more with fresh carbon. In the next cycle this carbon is used for pre-decolorization of the solution. This process permits not only maximum decolorization of the solutions but also protects the resin from an excessive quantity of colouring substances and colloidal compounds. As a result the life of the decolorizing resin and its efficiency are increased many times over.

To determine the effect of the individual colouring substances remaining in the solution on the colour of sugar from this solution a series of crystallizations was carried out under identical conditions. The value of the specific extinction of sugar crystallized from solutions decolorized by various means and of sugar crystallized from the basic remelt liquor is shown in Figs. 5 and 6.

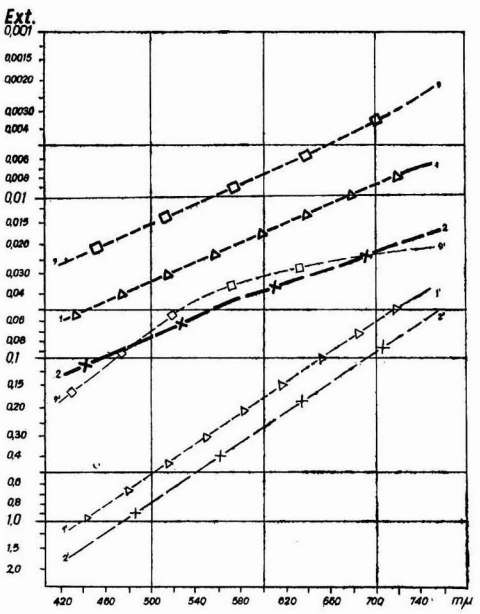


Fig. 5 Specific extinction of sugars crystallized from juices

Sugars: 1. Normal thick juice. 2. Caramelized thick juice. 9. Decolorized thick juice.
Juices: 1′. Normal thick juice. 2′. Caramelized thick juice. 9′. Decolorized thick juice.

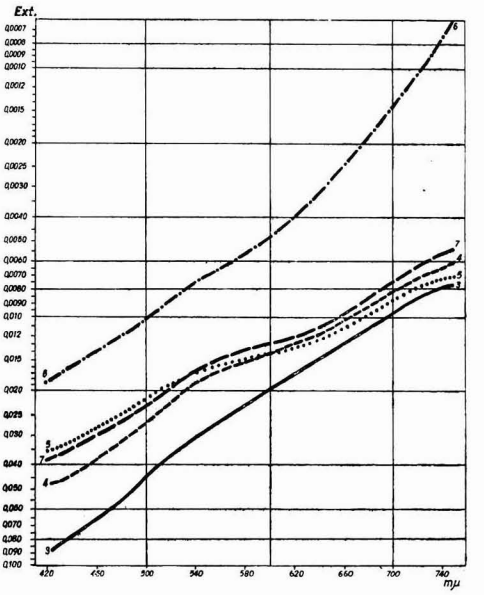
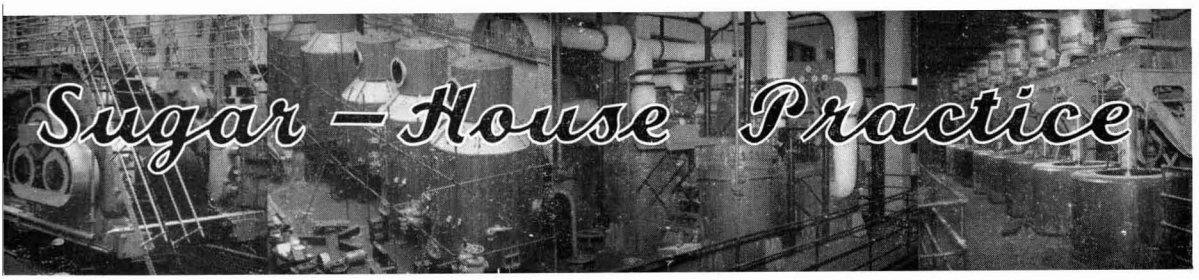


Fig. 6. Specific extinction of sugars crystallized from decolorized remelt liquor.

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.

As the graph shows, good sugars were obtained from solutions decolorized by the column method and with active carbon and resins. A somewhat higher specific extinction, particularly at short wavelengths, was found in sugars obtained from juices decolorized by the batch method. The best sugar was obtained from solutions decolorized by the combined method.

(*To be continued*)



Progress at the (Durban) bulk sugar terminal. A. GARSTANG. *S. African Sugar J.*, 1963, **47,** 808–809. Some information is provided on the construction aspects of the terminal, which is planned for completion in 1965. Illustrations are presented showing the work in progress on the site.

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The "Jose Maria Morelos" new sugar factory. A. FORS. *Sugar J.* (La.), 1963, **26,** (6), 12–14, 40.—Some information, mostly agricultural, is given on this new 1500-ton Mexican sugar factory and mention is made of another factory in course of erection ("Plan de Ayala") which is planned to have an ultimate grinding capacity of 6000–7000 tons of cane/day.

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Evaporator cleaning cycles. A. G. KELLER. *Sugar J.* (La.), 1963, **26,** (6), 16–21.—The time taken to clean evaporators at 17 Louisiana sugar factories varied widely, the average being just over 10½ hr. The complete process is broken down into the various stages of boiling with soda solution and subsequently with acid solution and some suggestions are made whereby the time can be reduced.

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Better control in second carbonatation by recirculation. B. B. PAUL. *Sugar J.* (La.), 1963, **26,** (6), 21–22.—The 2nd carbonatation system used at Daurala sugar factory is described. Filtered 1st carbonatation juice is mixed with recirculated hot (75°C) 2nd carbonatation juice and the combined juice (at 69–70°C) fed through a pipe approximately midway up the wall of the 2nd carbonatation vessel which delivers the juice above a conical distributor plate. Directly beneath this is a cylindrical wall having a closed top and open bottom forming an outer cylindrical compartment. Inside this is another cylindrical wall with a closed bottom through which passes an open-topped pipe forming an innermost compartment. Juice rises inside the outer compartment and overflows into the middle compartment from which most is withdrawn and sent to a heater before mixing with the filtered 1st carbonatation juice. The remainder of the juice rises inside the compartment and overflows into the central pipe through which it is withdrawn and sent to process. The CO_2 is admitted through a circular sparger at the bottom of the tank mounted below a perforated plate. Advantages of the scheme are discussed.

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Results of use of Hodag "Vap 99" at Central Plata. P. J. RODRÍGUEZ. *Sugar J.* (La.), 1963, **26,** (6), 24–26. "Vap 99", a surface-active agent[1], added at 0·013 lb per ton of cane crushed, kept evaporator tubes clean and permitted crushing of an extra 412 tons of cane per day and an increase in the evaporator rate of 14·21%.

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The case for a pre-heater. A. L. WEBRE. *Sugar J.* (La.), 1963, **26,** (7), 44–46.—Three cases are examined in which (i) juice is fed to the quadruple-effect evaporator at 205°F and a pre-heater is omitted, (ii) juice is pre-heated at 224°F (boiling point), and (iii) juice is pre-heated to 234°F, allowing 10° of flash. It is shown that adding a pre-heater to (i) would raise the capacity of the station to a level above that of (ii) at low capital costs, while bleeding 1st vapour would increase the advantages. Vapour bleeding in the absence of a pre-heater is discussed and it is shown that 60–75% more heating surface would be required in the 1st effect than in the other three effects.

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Glades County mill boosts Florida's cane sugar production, offers facilities for both grinding cane and refining sugar. ANON. *Sugar J.* (La.), 1963, **26,** (7), 64–65.—See *I.S.J.*, 1964, **66,** 133–134.

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Experimental unit for clarifying refinery syrups using anion-exchange resins. G. A. CHIKIN, V. P. MELESHKO, M. B. KLEIMAN and F. M. POLISHCHUK. *Sakhar. Prom.*, 1964, **38,** 105–111.—The scheme designed for the treatment of syrups (1st and 2nd refined and 1st product) at Krasnopresnensk refinery is described. The syrups are mechanically filtered and passed through a column of AV-16G strongly basic decolorizing resin. The column design is described. Tests showed that increase in the depth from 0·5 m to 1·0 m was accompanied by a 13·3% increase in the decolorizing efficiency. At 0·5 m the average decolorizing effect was 67·43 %compared with 13·65% using bone char. Increasing the syrup flow rate reduced the efficiency. The higher the initial colour content, the greater was the amount of colouring matter removed. Optimum conditions for regeneration with NaOH and NH_4Cl have been established, and data are tabulated showing the reagent and water usage in regeneration.

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Preparing floors for raw sugar storage. S. V. SLABOSPITSKII. *Sakhar. Prom.*, 1963, (12), 50–52.—Hints are offered on the manner in which to stack sugar, either in warehouses or in the open, for ease of stacking, reclaiming and dividing into smaller piles, while at the same time applying basic rules of safety and, in the open, protecting the sugar from atmospheric moisture. Drainage of rain water and the best types of floors to use are also discussed.

[1] Hodag Chemical Corp., Skokie, Ill., U.S.A.

Review on the process of cane juice clarification in sulphitation sugar factories. T. SURYANARAYANA RAO. *Indian Sugar*, 1963, **13**, 365–367.— Descriptions are given of seven methods of cane juice clarification, including the electrolytic and ion-exchange processes. Good results have been obtained by preheating raw juice to about 60°C, liming and sulphiting simultaneously to pH 7·0, with subsequent re-heating and settling. Correct liming and the effects of SO_2 are discussed briefly.

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Centrifuging and the modern centrifugals. U. C. UPADHIAYA. *Indian Sugar*, 1963, **13**, 425–435.—The theory of massecuite curing is discussed and factors influencing the curing time are enumerated. The advantages of continuous centrifugals are listed and the three basic types described. Batch centrifugals are discussed together with the types of drive used, electric drives being further sub-divided. The three main problems in centrifugal operation (discharging, braking and prevention of unbalanced loading) are considered as are washing, massecuite heating, control equipment and centrifugal power requirements.

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Criterion equation for heat calculation of massecuite crystallizers with cooling. I. S. GULYI and V. D. POPOV. *Trudy Kiev. Tekhnol. Inst. Pishch. Prom.*, 1963, **27**, 86–90.—An equation is presented for generalizing experimental heat exchange data in which the Nusselt number is related to the Reynolds and Prandtl numbers [$Nu_f = 0{\cdot}89\ Re_f^{0.45}\ Pr_f^{0.38}\ (Pr_f/Pr_w)^{0.25}$, where Pr_w = Prandtl number at wall temperature]. This is converted to an arithmetical equation for calculating the coefficient of heat emission (α_1) from massecuite to wall: $\alpha_1 = A_1 v^{0.45}$ kcal/sq.m./hr/°C, v being the rotary speed of the element and A_1 a function of thermophysical parameters of the massecuite. For a given massecuite purity, A_1 can be represented as a function of massecuite Brix and temperature. A nomogram is presented for determining α_1 assuming that $\alpha_1 \simeq k_4$, where k_4 is the heat transfer coefficient with a clean surface. The original equation is shown to be valid for 2nd and 3rd product crystallizers at $Re_f = 0{\cdot}02\text{–}0{\cdot}4 \times 10$ and $Pr_f = 0{\cdot}8\text{–}154 \times 10^3$. Changes in the various factors with time are also demonstrated graphically.

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Relationship between heat and mass transfer with massecuite cooling in crystallizers. I. A. BELOKON' and I. S. GULYI. *Trudy Kiev. Tekhnol. Inst. Pishch. Prom.*, 1963, **27**, 90–96.—Empirical equations are developed for calculating the increase in weight of the solid phase and the fall in weight, sugar content and Brix of the mother liquor in terms of the amount of heat removed from the massecuite during crystallization. Curves relating the factors are presented; these are based on pure sucrose cooled from 80 to 30°C (calculated) and on 1st cane and 3rd beet massecuite (experimental). Comparison between the data shows good agreement at high and moderate massecuite purities, whereas at low purities there is considerable divergence.

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Some data on the circulation of sugar solutions during evaporation. I. I. SAGAN'. *Trudy Kiev. Tekhnol. Inst. Pishch. Prom.*, 1963, **27**, 108–113.—In tests with a single-tube evaporator it was found that circulation increased with increase in the downtake:boiling tube cross-section ratio. Above a ratio of 1·0 water circulated at a far greater rate than did 60° and 75°Bx sugar solutions. The extent to which circulation varied depended on the diameter of the boiling tubes as well as the downtake:boiling tube ratio, while circulation also increased with rise in the pressure of heating steam.

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Investigation of metal durability in molasses. N. A. SOLOGUB. *Trudy Kiev. Tekhnol. Inst. Pishch. Prom.*, 1963, **27**, 113–119.—Cylindrical metal samples were subjected to tests in friction pairs after the sliding surfaces had been roughened and coated with molasses. Increasing the pressure and temperature caused increase in the wear of the metals, which included steel, bronze and cast iron of various compositions; however, the effects were not the same with all samples. The samples were subjected to microscopic and metallographic studies and the effect of lubrication also noted. The findings were confirmed by examining parts of a molasses pump made of the metals studied. Recommendations are given regarding their use.

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Determination of hydrodynamic depression and value of the boiling point in vertical evaporators. I. M. FEDOTKIN. *Trudy Kiev. Tekhnol. Inst. Pishch. Prom.*, 1963, **27**, 120–132.—Formulae are developed for calculating (i) the superheating of a solution in a tube and (ii) its boiling point in terms of a number of factors, including the effective level of the solution, its circulation rate, s.g., viscosity, heat flow, the ratio of axial to radial heat flow, the resistance to entry of the solution into the tube, etc. The effect of ratio of downtake cross-section area to boiling tube cross-section area on the boiling point and its depression is discussed. It was found that the maximum superheating at the boiling point can be considerable for a Kestner evaporator. A worked example is presented.

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Fluidization techniques and their application in the sugar industry. L. NEUZIL and V. VALTER. *Listy Cukr.*, 1964, **80**, 4–7.—The fundamentals of fluidization are discussed and possible applications in the sugar industry considered, including calcining of carbonatation mud[1] and drying and cooling of refined sugar. Pneumatic conveying of sugar, however, is restricted because of crystal abrasion.

[1] ZAGRODZKI & FORNALEK : *I.S.J.*, 1962, **64**, 48.

Natural alkalinity. P. M. SILIN. *Sakhar. Prom.*, 1963, (12), 29–30.—The authors of a previous article[1] assume natural alkalinity to be represented by the Na + K present, in terms of their carbonates. This is not the true natural alkalinity since the latter is affected by the presence of soluble calcium salts; in the case of badly deteriorated beets, these may be so much greater as to more than balance the K and Na present, when carbonatation will not remove all the Ca present and the natural alkalinity is in fact negative although the Na + K would correspond to a positive "natural alkalinity" as defined by ARKHIPOVICH *et al.*[1].

* * *

The effect of beet pol on sugar losses in beet during storage. T. I. SOROKINA. *Sakhar. Prom.*, 1963, (12), 45–46.—Tabulated data show that in beet stored for periods up to 100 days or more sugar losses are generally slightly greater with the beet of higher pol (19% *vs.* 17%).

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Modernization of centrifugal pump glands. A. P. PARKHOD'KO. *Sakhar. Prom.*, 1963, (12), 47–49. Details are given of modifications to centrifugal pumps, in which the elastic packing has been replaced by a system of rubber cups with spiral springs to prevent juice losses through the packing. It is noted in an editorial footnote that the system described is not the best and the reader is referred to other literature on the subject.

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Improving the performance of equipment in the lime section. I. V. KACHAILO. *Sakhar. Prom.*, 1963, (12), 49–50.—At Parkhomovsk milk-of-lime is now fed into the second compartment of a sand trap instead of the section housing the screw for removal of the sand, which now does not become muddy. A belt conveyor for lime has had its drive and driven pulleys modified to prevent the conveyor slipping.

* * *

Quantity control in molasses tanks with magneto-elastic load cells. H. OLBRICH. *Zeitsch. Zuckerind.*, 1963, **88,** 684–686.—Details are given of a Siemens & Halske A.G. load cell which may be applied to weight recording or control with molasses tanks. If a force is exerted on the load working surface, a compressive strain is created in that part of the cell permeated by magnetic flux and so causes a change in the magnetization and thus in the permeability of the ferro-magnetic material. Thus the permeability is a function of the apparent resistance. Two circuits of constant voltage at grid frequency pass through a voltage transformer. In one is the load cell variable resistance and in the other a facsimile. The difference between the current flowing in the two circuits, i.e. the value of the apparent resistance change, is indicated through a measuring circuit by an instrument suitably calibrated in tons or kilograms and/or is recorded and used for actuation of control means.

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The beet sugar factory at Kiryat-Gat. L. LANG. *Sugar y Azúcar*, 1963, **58,** (12), 24–25.—Some information is given on the processes and equipment at this 1650 tons/day factory in Israel. An RT diffuser is used and losses to pulp are 0·25–0·27% at 105–110% juice draught. Conventional liming and carbonatation are used. Second carbonatation juice is filtered on Stellar filters. The evaporator is a quintuple-effect and six vacuum pans are used for a 3-massecuite system. In its first campaign the factory suffered because of low beet pol caused by extremely high temperature which necessitated early harvesting before the beet had attained maturity in order to avoid rotting.

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Experience in the use of Olier diffusers. N. N. PUSHANKO. *Sakhar. Prom.*, 1964, **38,** 21–24.—Some structural and design features of Olier diffusers made in Czechoslovakia and installed at Borshchevskii sugar factory are noted. Some defects have arisen, particularly in the driving gears (teeth shear due to three main causes) and the conveyor system (rupture of flanges in the T-shaped chain and teeth shear). Modifications have been made to remedy these faults.

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Calculation of the throughput of a twin-scroll trough-type diffuser. V. M. PRIIMAK. *Sakhar. Prom.*, 1964, **38,** 25–26.—Formulae are presented for calculating the throughput of a twin-scroll DdS diffuser and for calculating the so-called "feed coefficient" ($= L/Snz$, where L = length travelled by cossettes in z min, S = scroll pitch and n = scroll speed). The movement of cossettes along the trough is compared to the screwing of a nut on a bolt when the latter is rotating and not the former.

* * *

Systems of control of the electric drive of beet slicers and of continuous diffusers with non-linear elements. A. V. DAN'KO and V. E. KRUTIKOVA. *Sakhar. Prom.*, 1964, **38,** 30–33.—The choice of system for power feed from generator to prime mover in the case of beet slicers and continuous diffusers is discussed with respect to the control possibilities. The schemes described include semi-conductor rectifiers and are considered more reliable and cheaper than D.C. systems with static voltage transformers.

[1] ARKHIPOVICH *et al.*: *I.S.J.*, 1964, **66,** 128.

Device for regulating milk-of-lime feed to defecation. A. L. ANTONOVICH. *Sakhar. Prom.*, 1964, **38**, 36–38. Compressed air acts on a membrane, thereby causing movement of a spiral spring and consequently raising or lowering, by means of guide rods, a cone valve inserted in the end of the milk-of-lime feedline. The milk-of-lime is discharged through a port in the conical bottom of the measuring tank in which the device is installed.

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Blowing through the screens in a pre-scalder and KDA tower diffuser. N. S. KARPOVICH. *Sakhar. Prom.*, 1964, **38**, 38–39.—A hot water pipeline system is used to remove pulp from pre-scalder and diffuser screens when these become blocked with pulp. The sequence of valve operations is described.

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Regulating the thickness of beet cossettes "in operation". A. P. PARKHOD'KO. *Sakhar. Prom.*, 1964, **38**, 39–43.—Descriptions are given of two knife frame designs which permit the thickness of cossettes to be regulated without stopping the slicer. In both cases the turn of a bolt adjusts the height of the knife blade, 2–3 and 4–5 min respectively being required to adjust all the knives in one slicer.

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Grip for fastening bags to the frames of mechanical filters. A. V. KISELEV. *Sakhar. Prom.*, 1964, **38**, 43–44.—To the end of each frame is attached a spring-loaded slide bar with a conical end corresponding to a clamping device on the filter wall. The bags are held by a strip in turn held by a clamp fixed to the spring device.

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Calculation of the moments of oscillation with batch sugar centrifugals. K. PAUSE. *Zeitsch. Zuckerind.*, 1964, **89**, 25–28.—Calculation of the moments of oscillation of a discontinuous centrifugal ($= GD^2$, where G = weight and D = dia.) is explained mathematically. It is shown that a distinction must be drawn between constant and variable dimensions. In the calculation of inertia, massecuite should not be considered as a homogeneous cylinder, and sugar and run-off must be considered separately. The initial massecuite must be the actual quantity of massecuite and not that given by the effective volume of the basket. The crystal content, sugar yield, wash water and speed ranges within which changes in dimensions take place must all be taken into consideration. Graphs are given showing the moments of oscillation at various speed ranges and the general centrifugal effect.

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Experimental study of the rate of freezing of beet. V. Z. ZHADAN and M. Z. KHELEMSKII. *Sakhar. Prom.*, 1964, **38**, 100–105.—Wind tunnel tests showed that freezing and subsequent de-frosting causes increase in beet dry solids. With lower dry solids, the freezing period increases slightly; variations in the dry solids have a greater effect on the freezing period than on the cooling period. The final temperature difference between beet and air affects cooling more than it does freezing. The cryoscopic temperature of the beet has a negligible effect on the freezing period, since as it increases so too does the average temperature difference between the beet and air. The freezing period rises sharply with increase in beet diameter. The flow rate of the air has a pronounced effect on the freezing period with small beets. An empirical formula is presented for calculating the upper limit of air flow as a function of beet diameter. The cryoscopic point of beet was found to be somewhat higher than of beet juice from the same root.

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Recycling of condenser water and condensates to the reservoir. A. D. BAGLYUK. *Sakhar. Prom.*, 1964, **38**, 111.—Instead of by-passing excess cold water together with excess condenser water and condensate to the main pipeline via the aerators and coolers, the cold water should be fed by a separate route omitting aeration and cooling.

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Beet storage by freezing. V. S. RYMARENKO. *Sakhar. Svekla*, 1962, **7**, (9), 16–19.—Practices used in Altai (Siberia) for beet storage from September to March or later are described. The beet are piled around wooden air ducts of triangular section or on concrete bases with underground air ducts (the latter method is preferred). The beet are cooled by forced ventilation to —13 to —15°C and are then covered with a 25–30 cm layer of snow. Total sugar losses are approximately 0·2–0·8% on beet.

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New direction in the technique of filtration of 1st carbonatation juices in the sugar industry. M. LOREAN. *Ind. Alim. Prod. Veg.*, 1962, **13**, 334–338; through *S.I.A.*, 1963, **25**, Abs. 1085.—The Fives Lille-Cail and Philippe rotary disc type mud thickeners are described, with a flow diagram for their operation in conjunction with a rotary vacuum filter for continuous juice filtration.

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Examination of causes of pH change in sugar solutions during electrodialysis with ion-exchange membranes. L. D. BOBROVNIK and I. M. LITVAK. *Trudy Kiev. Tekhnol. Inst. Pishch. Prom.*, 1963, **27**, 35–42.—In 0·5M and 1M sugar solutions the absolute mobility of the Cl^- ion in K, Na and Mg chlorides was greater than that of the cations; however, in the capillaries of membranes impregnated with electrolyte solutions, the cation mobility was found to be greater than the anion mobility. This would result in a drop in pH during electrodialysis of technical sugar solutions, and, to prevent this, free lime may be added or the dialysate passed through a strongly basic anion exchanger. Using AB-16 resin of this type, the pH of a 91 purity dialysate of pH 4·4 was raised and almost complete decolorization effected.

Test of a method of settling 1st carbonatation juice with the addition of raw juice. M. KH. LIKHITSKII, L. D. BOBROVNIK and M. I. BARABANOV. *Trudy Kiev. Tekhnol. Inst. Pishch. Prom.*, 1963, **27**, 46–51. The effect of raw juice on 1st carbonatation juice settling and filtration was studied and the optimum raw juice addition found to be 5–10% by volume, at which the settling rate is increased and supernatant juice quality improved while filtration properties are not impaired. Intensive mixing of 1st carbonatation juice with and without raw juice added had an adverse effect on settling, as had transferring of the mixed juice from the carbonatation vessel to a settler by centrifugal pump. Juices should be mixed in a separate tank above the settler and fed under gravity. Laboratory tests showed that adding 5–10% raw juice by volume to 1st carbonatation juice does not adversely affect 2nd carbonatation juice purity and at 15–20% causes only a negligible drop in purity.

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Separation of colloidal non-sugars coagulate after pre-liming. K. D. ZHURA and S. T. VIL'CHINSKII. *Trudy Kiev. Tekhnol. Inst. Pishch. Prom.*, 1963, **27**, 51–55.—Pre-limed juice samples were filtered before main liming and carbonatation. It was found that the albumin content in the carbonatation mud was much greater than when filtration was omitted (approximately 87–91% *vs.* 15–22% of the original content in raw juice). However, the amount remaining in the juice was about the same in both cases (7–11% with filtration and 9–13% without). Similar tests to determine pectin removal showed that the content in 1st carbonatation mud with and without filtration was 17–22% and 48–52% of the original raw juice content respectively. The 2nd carbonatation juice purity was raised from 93–94 to 95–96 by pre-filtration. With filtration after pre-liming, return of 1st carbonatation juice to pre-liming (1:1) had little additional effect on pectin removal.

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The behaviour of pectin substances in juice purification and sucrose crystallization. I. A. PRIKHOD'KO. *Trudy Kiev. Tekhnol. Inst. Pishch. Prom.*, 1963, **27**, 61–66. In laboratory tests in which pure pectin preparations obtained from beet and dry pulp were added to sugar solutions before liming and gassing to optimal 1st and 2nd carbonatation pH, approximately 50–70% of the original pectin content was removed as alkaline degradation products. The quantity of pectin separated was found to be dependent on the composition of the pectin, the length of time the preparation was stored and the sucrose content in the solution. In further tests, addition of pectin as alkaline degradation products to molasses (3·0–9·0% on weight of molasses) had no effect on sucrose solubility, did not increase the melassigenic coefficient and caused only slight increase in viscosity. In fact, in some cases the melassigenic coefficients and viscosities were even slightly lower than without pectin addition.

Purification of sugar factory waste waters. L. ZANONI. *Ind. Sacc. Ital.*, 1963, **56**, 267–274.—Types and characteristics of the types of waste water from a beet sugar factory are listed and methods of treating them for recycling are discussed, with reference to the literature. Three schemes in use in Italian factories all involve settling (one after addition of 600 p.p.m. CaO) and give a clear liquid but do not reduce the BOD_5.

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The heat transmission coefficient in the first body of an evaporator. O. CHIOETTO. *Ind. Sacc. Ital.*, 1963, **56**, 275–278.—Calculations of heat transfer coefficients show that, in the first body, thin juice is brought from feed temperature to boiling point in the bottom part of the tube where a low heat transfer coefficient applies (e.g. 9·2 kcal/sq.m./min/°C). In the remainder of the tube the coefficient increases with height, reaching a value of 118·8 kcal/sq.m./min/°C. The overall coefficient for this section is 64 kcal/sq.m./min/°C while the overall coefficient for the whole of the tube is 48·5 kcal/sq.m./min/°C. Thus preheating the juice to the boiling temperature would improve the evaporator efficiency.

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Beet storage at Gross-Gerau (sugar factory). T. CRONEWITZ. *Zucker*, 1964, **17**, 64–67.—The beet may be unloaded from road and rail trucks simultaneously by water jets at 350 t/hr (compared with a factory slice of 100 t/hr) and pass along separate flumes to the main flume. After trash and stone removal, the beet pass via a vibratory screen and a sloping rake conveyor to a wash tower, are sprayed with water (and formalin when required) and passed over a vibratory grid. Tails are separated during this treatment. The beet then pass via belt conveyors to a mobile bridge spanning the width of the 50 m long beet pile. The bridge is equipped with a 20 m long storage platform which moves vertically and unloads the beet to a maximum height of 8 m. The maximum drop the beet are subjected to is 1·5 m (in an empty storage lot). A swivel television camera at the end of the platform allows the operator in the control house at the wash tower to adjust for minimum drop when his visibility is impeded. The beet are reclaimed, longest stored ones first, via another flume with a second stone catcher and vibratory screen, two conveyors and a grid and pass to the 30–35 ton hopper above the slicers. The tails are treated together with the dirty water in cyclone washers and then pass directly to the factory conveyor. The wash and flume water flows in a closed circuit to and from a clarifier station. The various controls of water flow and of beet movement as dependent on the hopper level or with deteriorated beet passing direct to the factory are described. During 1962/63 75% of the beet entering the factory were completely clean and the remaining 25% had only 0·6% dirt adhering.

NEW BOOKS AND BULLETINS

The Tanganyika Planting Co. Ltd. 20 pp; 10 × 7¼ in. (The Tanganyika Planting Co. Ltd., P.O. Box 93, Moshi, Tanganyika.) 1964.

This small booklet is a well-illustrated account of the activities of the Tanganyika Planting Company from its foundation by A. P. MOLLER in 1930 to the present day. The first crop was harvested in 1936 and processed in a small old-fashioned factory under conditions of some difficulty. But the cane lands have developed and output of cane per acre has risen—from 50 tons per acre in 1956/57 to 75 tons per acre in 1962/63. Water conservation and utilization for irrigation is described, as are aspects of cultivation, harvesting and processing to sugar. Research facilities are mentioned and illustrated, as are social facilities for the workers—housing, medical care, education, etc.

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Museu do Açúcar. (Sugar Museum). (Museu do Açúcar, Av. 17 de Agôsto, No. 2223, Recife, Pernambuco, Brazil.) 1964.

This leaflet is printed in Portuguese and English and describes this specialized technical museum which operates under the auspices of the Instituto do Açúcar e do Alcool, and is open from mid-day to 6 p.m. on week days and 2—5.30 p.m. at week ends. Its exhibits include models of equipment and apparatus used in the industry, pictures, porcelain and chinaware, private coins used in the sugar mills, stamps having a sugar industry design, etc., and there is a library which contains not only technical books, some of them rare works, but also photographs, maps, drawings, gramophone records and films.

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Teorie Optimálního Schématu Rafinace Cukru. (Theory of an Optimal Sugar Refining Scheme.) J. BURÍANEK. 189 pp.; 6 × 8⅛ in. (Státní Nakladatelvství Technické Literatury, Spálená 51, Praha 1, Czechoslovakia.) 1963. Price: 15.50 Kčs.

The theory of refining is described on the basis of refinery and analytical data, the procedure adopted being the resolving of a vector into its components. The principles governing refining are mainly only empirical and hence optimization of the complete refining process or of the individual stages is prevented. The parameters having greatest influence on refining efficiency and which still present obstacles to overall improvements include determination of the optimal sugar content of a massecuite, optimal amount and temperature of wash water in affination and the optimal proportion of molasses (by weight) removed in affination and curing. The accumulation of sufficient colouring matter to necessitate its removal from syrup is attributed to defects in various individual processes. Great importance is attached to the drawing up of sucrose and non-sugars balances. The subjects are dealt with in seven chapters, each with a summary in Russian, German and English; the English, though somewhat below standard, is still fairly intelligible. The value of the book, which contains many diagrams, formulae and tables, to the world sugar refining industry would be enhanced if it were available in a language with which more technologists are familiar outside Czechoslovakia.

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World and U.S. Domestic Price Movements. (C. Czarnikow Ltd., Plantation House, Mincing Lane, London E.C.3.) 1964.

This is a chart prepared and published by Czarnikows, excellently printed in six colours and covering the period January 1956—December 1963. It records weekly variations in the London Daily Price, New York No. 4 and No. 8 Contract spot prices, and the New York No. 6 and No. 7 (Domestic) Contract spot prices. The Commonwealth Negotiated Price is also recorded on the chart which is provided with ordinates of cents per lb and £ per ton. Factors having important effects on the prices over the period are noted at the appropriate places. An inset panel provides a chart of average world values annually from 1925 to 1963.

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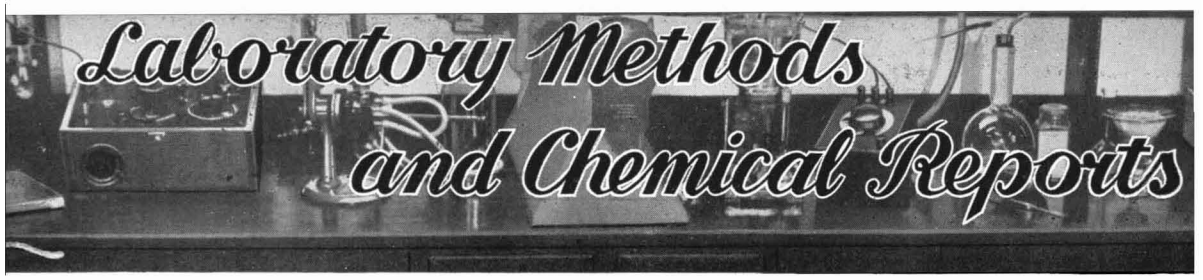
The Sugar Tramp, 1963. Ohio, M.S.G., Indiana, Illinois. D. GUTLEBEN. 314 pp; 8½ × 11 in. (Dan Gutleben, 1366 Mt. Pisgah Road, Walnut Creek, California, U.S.A.) 1963.

As recorded before in these pages, Dan Gutleben has, since his retirement, been producing at intervals his "Sugar Tramp" which collects and records amusing and interesting details of sugar men and their deeds and misdeeds, the factories and their fortunes, mostly in the U.S.A. but often outside—in Europe, Hawaii and elsewhere.

In this latest volume, the four basic themes are the three states of the title and M.S.G.—mono-sodium glutamate. This last is an account of the development of the manufacture of this flavour-enhancing material from concentrated Steffen filtrate, while the other three chapters refer to sugar factories still in existence or closed, with accounts of their building, operations, troubles and achievements.

All sections are fascinating to read and are in a narrative style plainly evidence of the fact that compilation is a labour of love for the author. We look forward to future editions from the Gutleben pen.



Development of a rapid method for determination of sucrose in beet, cossettes and pulp[1]. A. DRABIKOWSKA. *Prace Inst. Lab. Badawczych Przemyslu Spozywczego*, 1962, **12**, (4), 1–19; through *S.I.A.*, 1963, **25**, Abs. 951.—Preliminary experiments with rasped beet showed that cold digestion with aqueous alcohol for 5 min, or cold aqueous digestion in a high-speed homogenizer of Hungarian or Polish construction for 5 min, gave the same sucrose contents as standard hot digestion for 30 min. A minimum digestion time of 3 min was obtained in a "Waring Blendor". Cossettes were divided with a knife into pieces 3-5 mm long before homogenizing in 178·2 ml of acetate solution. The results were again the same as those of hot digestion and were independent of whether a 26 g or 52 g sample was used. Juice was extracted from pulp in a cylindrical press, "Hafico" press or screw-type mincer for extraction of fruit juice; the latter gave the best results with fresh pulp. Complete extraction of sucrose in the presses was obtained only after previous mincing of the fresh pulp (e.g. in a meat mincer). The use of a homogenizer on 52 g of pulp in 150 ml of acetate solution gave results ~5% lower than when the juice was extracted.

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Detection of phenolic compounds by chromatography in beet sugar molasses. Y. OBATA, Y. SENBA and M. KOSHIKA. *Agric. Biol. Chem.* (Tokyo), 1963, **27**, 340–341; through *S.I.A.*, 1963, **25**, Abs. 962. Catechol, *p*-hydroxybenzoic acid, melilotic acid, salicylic acid, syringic acid, vanillic acid and vanillin were identified by paper chromatography of molasses fractions separated by extraction with ethanol and ether, and by column chromatography on activated alumina. Three other spots were not identified.

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Determination of reducing substances in sugar factory products. II. M. FRIML and A. MIKOVÁ. *Listy Cukr.*, 1963, **79**, 311–315.—Experiments were made to determine invert sugar in the presence of sucrose with Ofner's reagent, followed by complexometric titration of the reduced copper with EDTA using murexide indicator. Ofner's reagent proved unsuitable in its usual form since at a higher concentration of Rochelle salt in the reagent the complex formed between the copper and murexide is suppressed by the formation of a complex between Cu and the salt. With a reduction of the Rochelle salt concentration (to 75 g/litre of reagent) the accuracy attained is very high, giving results in close agreement with those using the DE WHALLEY method[2]. It was possible to use 0·00323N EDTA, 1 ml of this corresponding to 1 mg of invert sugar. The correction for the reducing capacity of 5 g of sucrose is 5·6 ml 0·00323N EDTA.

Effects of severe freezing on quality of mill cane. J. E. IRVINE and L. G. DAVIDSON. *Sugar Bull.*, 1963, **42**, 54–58.—Rapid deterioration in cane was found after very sharp frosts and Brix, pol and purity of juice fell appreciably in juice samples taken two days after freezing and continued to drop for the duration of the test. The titratable acidity rose and pH fell at a rapid rate. Cane cut with normal topping fell below permissible standards 7–9 days after freezing. Varietal differences may appear after complete freezing. Completely frozen cane deteriorates two days after freezing while after a moderate frost changes are detectable 6–16 days later. Lower topping may be used to increase resistance to changes in frozen cane.

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Determination of refined sugar purity. A. R. SAPRONOV. *Sakhar. Prom.*, 1964, **38**, 17–20.—Ultraviolet spectrometry was tested as a means of determining refined sugar purity. Measurements of the optical density of 50°Bx solutions from various refineries confirmed that with reduction in wavelength there is a sharp rise in loss of light. The impurities are calculated by deducting the optical density of a pure sucrose solution of the same concentration from the total optical density (distilled water being considered preferable as a standard because of difficulties in obtaining and keeping a pure sucrose solution under factory conditions). Errors in photometric measurements of white sugar solutions are attributed to lack of a uniform filtration method. While optical densities of a white sugar solution filtered by 10 widely differing methods were almost identical in the visible spectrum, in U. V. light the values diverged considerably. In both parts of the spectrum the most stable results were obtained with a No. 4 glass filter and river sand with asbestos, although for practical purposes the glass filter with a 1 cm layer of asbestos is recommended. A wavelength of 260 mμ is recommended with a 50% sugar solution.

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Heat content of beet and amount of cold needed to freeze it. V. Z. ZHADAN and M. Z. KHELEMSKII. *Sakhar. Prom.*, 1964, **38**, 20–21.—A formula is presented for calculating the heat content (enthalpy) of beet. The amount of cold used to cool and freeze beet is calculated using a second formula based on the difference between the heat contents at the initial and final temperatures. Worked examples demonstrate the effects of dry solids content and cryoscopic temperature on the amount of cold needed.

[1] *Cf. I.S.J.*, 1963, **65**, 343.
[2] *I.S.J.*, 1937, **39**, 300.

Hygroscopic properties of cane raw sugar and its storage conditions. V. E. STETSYUK. *Sakhar. Prom.*, 1964, **38**, 27–29.—The effects of dampening and drying of raw sugar in storage and in transit are discussed, and tests are described in which cane raw sugar of known composition was placed in weighing bottles over hermetically-sealed glass jars containing sulphuric acid. The equilibrium humidity was determined at –5, 0, 20 and 40°C and the weight changes in the samples noted periodically until equilibrium was attained. A graph of the results shows how the increase in moisture content of the sugar decreased with temperature increase at a given R.H. until at 40°C there was a slight decrease at all relative humidities. The significance of the safety number in determining the upper "critical" limit of raw sugar moisture content is discussed. The various factors discussed are applied to the case of Cuban raws shipped to the Soviet Union and recommendations regarding storage are given. These refer specifically to ventilation and to artificial increase of sugar moisture under given conditions. Tests have shown that dampening of sugar by absorption of water vapour from the air proceeds more slowly than dampening by condensation (several days as opposed to 10–15 min). Worked examples are given to show when ventilation and dampening are advisable.

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Study on the fractionation and determination of the main metallic cations in cane juice by ion-exchange column chromatography. P. T. HSIEH, T. S. SHIH and S. S. LI. *Chemistry* (Taiwan), 1962, **4**, 129–136; through *S.I.A.*, 1963, **25**, Abs. 1059.—Cane juice was passed through a column of "Amberlite IR-120" (H form), and the column was successively eluted with 0·1N HCl (Na^+, K^+), 0·5N HCl (Mg^{++}, Ca^{++}) and 3N HCl ($Fe^{+++} + Al^{+++}$). The alkali and alkaline earth ion eluates were titrated with NaOH and EDTA respectively; Fe^{+++} and Al^{+++} were determined respectively by the *o*-phenanthroline method and by the aluminon method after removing Fe^{+++} with 50% KCNS. Typical results (in mg/litre) were: Na_2O, 308·5; K_2O, 1329·4; MgO, 222·0; CaO, 441·1; Fe_2O_3, 17·0; Al_2O_3, 18·0. In addition, 10·5 mg/litre of Fe_2O_3 and 4·0 mg/litre of Al_2O_3 were not retained on resin (i.e. non-exchangeable). The method is thus only applicable to Na, K, Mg and Ca in cane juice.

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Simplifying and improving continuous control of the sugar house. T. P. KHVALKOVSKII. *Sakhar. Prom.*, 1964, **38**, 34–36.—Determining refractometric Brix by the normal dilution method as still practised in many Soviet sugar factories gives inaccurate results, and adoption of the ICUMSA recommendation regarding 1:1 dilution is advocated. Massecuite Brix and purity determinations are considered superfluous and analyses should be restricted to molasses, run-offs and massecuite sugar content (the last only periodically in random or average samples), the molasses and sugar content being used to calculate the crystal content. A procedure for run-off analysis is described.

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Refractive indices and densities of aqueous solutions of invert sugar. C. F. SNYDER and A. T. HATTENBURG. *U.S. Nat. Bur. Stand. Monogr.*, 1963, (64), 6 pp. The refractive indices and densities were determined at 15, 20, 25 and 30°C at invert sugar concentrations up to 82% by weight. Equations are derived relating the refractive index and invert sugar concentration (% weight in air) and the absolute density and invert sugar concentration (% weight *in vacuo*) at each temperature. Tables are given of the refractive indices and densities of solutions containing up to 85% sugar for each % invert sugar at the four temperatures.

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Whiteness and colour type of refined sugar. R. D. VLETTER and L. F. C. FRIELE. *Zucker*, 1964, **17**, 35–41.—The whiteness of refined sugar samples was measured with a Zeiss "Elrepho" photometer using the C.I.E. tristimulus system as basis. The reflectance values FMY and FMZ are so related that whiteness $= FMY - k(FMY - FMZ)$ where k is constant, FMY = the brightness and (FMY — FMZ) = the saturation. A partial correlation was found between Mean Aperture (M.A.) and FMY where the correlation coefficient $R = 0{\cdot}82$. It was found that saturation has a dominating effect on whiteness and that a whiteness formula with saturation and brightness as variables gives better agreement than a formula involving saturation alone. Grain size affects only the brightness. In a graph of FMY *vs.* (FMY-FMZ) the lines of constant whiteness are parallel with the FMY axis. A regression formula is derived where whiteness = 0·6404 (FMY-FMZ) — 0·0777 FMY + 4·70. Comparison between calculated values and the Braunschweig colour types showed good agreement, with a measuring accuracy of 0·1% reflectance.

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Simplified data processing. W. SCHMIDT. *Zeitsch. Zuckerind.*, 1964, **89**, 18–25.—The use of electronic computers for rapid data processing is discussed. The advantages over the classic statistical methods, especially where the aim is to work out the best type of sampling technique giving precise conclusions on average values, are discussed and illustrated by examples. The average beet sugar content can be very quickly determined from samples using a table set out by NAIR[1] showing the confidence intervals for the median in samples from any continuous population. This is valid for any variables with continuous variation. The "confidence intervals", within which are the averages for the whole of the material, will be wider or narrower according to the number of samples. Other such tables developed by authors for rapid determination of various factors are described.

[1] *Sankhya*, 1940, **4**, 551–558.

Physico-chemical structure of sucrose solutions. A. R. SAPRONOV. *Sakhar. Prom.*, 1964, **38**, 97–100.—Solutions of pure sucrose of varying concentration were studied spectrophotometrically. Considerable light dispersion occurred in the U.V. spectrum. In aqueous solution, increase in the sucrose concentration was accompanied by a reduction in the light losses per unit concentration. This is attributed to a decrease in the hydration number of the sucrose molecules. With increase in the sucrose concentration in water-alcohol solutions, the light losses per unit concentration increased as a result of molecular association. Values of $(r_2/r_1)^3$ (r_1 and r_2 = radii of sucrose molecules respectively in dilute and concentrated solutions) calculated from the results show that whereas in dilute alcohol-water solutions the size of the sucrose molecules remains practically unchanged with changes in concentration and combine when the concentration is increased, in aqueous solutions they do not associate and no crystals are formed spontaneously in super-saturated solution even after long storage. If alchohol is added, this takes up the water and the number of hydration molecules is reduced and the hydration film then destroyed, permitting molecules to associate and crystals to form. The mechanism of viscosity of sucrose solutions is explained in terms of molecular interaction, and a reduction in viscosity with increase in temperature is ascribed to increase in molecular movement and expansion of the solution.

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Determining the amount of reducing matter in molasses. V. M. KATS and S. S. BENINA. *Sakhar. Prom.*, 1964, **38**, 117–121.—Comparison of three official methods for reducing matter determination revealed wide divergences in the results. On the basis of tests, the following recommendations are made: lead acetate to be used instead of Herles' reagent, which gives lower values, the excess lead being removed with sodium carbonate or sodium diphosphate (ammonium monophosphate gives lower values); a correction to be made for iodine consumption (1 c.c. iodine per mg of invert sugar); the sample to be prepared by clarifying a 20-g sample with 10 c.c. reagent, making up to 100 ml and filtering, adding some drops of phenolphthalein and soda solution to 50 c.c. of the filtrate to give alkaline reaction, making up to 100 ml and filtering. A snap determination to within 0·1% accuracy can be made without clarification. Active carbon treatment after clarification lowers the reducing matter content.

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A method of determining sugar cane quality in Louisiana. J. J. SEIP. *Dissert. Abs.*, 1963, **24**, 1110–1111; through *S.I.A.*, 1963, **25**, Abs. 1052.—Current methods of payment are reviewed. The Louisiana system, based on quality of normal juice, fails to take into account the quantity of juice in the sample, and also introduces arbitrary milling factors. The new method is based on (1) Brix and pol extraction by a sample mill, calculated from quality and quantity of extracted juices, (2) factors relating the sample mill to a standard level of factory extraction efficiency, and (3) a standard boiling house retention. A satisfactory correlation was found between factory and sample pol extraction, using either a three-roll hydraulically-loaded sample mill or a cotton-seed screw press.

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Relative velocity of non-sugar ion removal in electrodialysis with ion-exchange membranes. L. D. BOBROVNIK and I. M. LITVAK. *Trudy Kiev. Tekhnol. Inst. Pishch. Prom.*, 1963, **27**, 31–35.—Data are given of the extent and rate of removal at 50°C of anions and cations from 30°Bx solutions comprising 0·1N solutions of specific non-sugars added to 1M sucrose solution, while graphs show the change in amperage with time for the various non-sugars. Amides and nitrogenous compounds were removed at a considerably slower rate than the first impurity separated: a complex of salts of strongly dissociated acids. Cations were removed in the decreasing order $K^+ > Na^+ > Ca^{++} > Mg^{++}$ while anions were removed in the decreasing order chloride > oxalate > sulphate > citrate > lactate > tartrate > glutamate > asparagine and betaine.

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Rapid method of determining the colour of granulated sugars. P. V. GOLOVIN and E. A. GRIVTSEVA. *Trudy Kiev. Tekhnol. Inst. Pishch. Prom.*, 1963, **27**, 42–46. Twelve sugar standards having a colour ranging from 0·4 to 1·4°St are placed in trays assembled on a common base in rows of two under a light source comprising two blue-light bulbs shining through frosted glass. Samples for examination are screened and the fraction through the 0·75 mm but retained on the 0·5 mm screen is placed on a tray identical in size and shape to the ones containing the standards. This tray is slid between the rows of the standards for matching. Should no exact match be found, the colour is taken as the average of the two closest colours. The equivalence of optical density units in °St has been determined at 413 and 560 mμ and straight line graphs of the results are presented.

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The volatile acids and total nitrogen contents in some Polish molasses. M. GAWRYCHOWA. *Gaz. Cukr.*, 1963, **71**, 304–306.—Examination of beet molasses samples from different Polish factories and at various times showed that the molasses quality based on beet quality and processing conditions is suitably expressed by A/N, where A = the volatile acids content and N = total nitrogen content. For molasses from healthy beet the ratio will be much lower than unity, while for deteriorated beet and/or poor processing conditions the value is generally >1.

BY-PRODUCTS

Solvent retentivity experiments with sugar cane wax and its modified derivatives. II. Effect of blending different modified derivatives and addition of metallic stearates to the polish composition. S. BOSE and A. N. SHRIVASTAVA. *Sharkara*, 1962, **5**, 126–131.—Experiments on solvent retentivity of wax gels containing mixtures of modified cane waxes, paraffin wax and solvent and a gel corresponding to shoe polish composition are discussed. The effect of adding zinc and aluminium stearates, singly or combined, was investigated. It was found that a mixture of ethylene diamine and glycerol ester derivatives of cane wax (1:4) gave the most satisfactory results as regards the solvent absorptive capacity, solvent retention, firmness and appearance. The firmness may be increased by adding 6% zinc stearate.

* * *

Supplementing winter grazing with sugar cane. C. E. HAINES and F. LE GRAND. *Sugar J.* (La.), 1963, **26**, (7), 47–49.—Chopped sugar cane fed during 3 winters to yearlings as supplementary feed to para grass pasturage raised the average weight by 52 lb per animal, while yearlings on Roselawn St. Augustine grass and on bahia grass pastures gained 8 and 15 lb respectively when fed with supplementary cane. Severity of the winter and type of grass affected the response to cane, daily intakes of which varied from 15 to 25 lb per animal.

* * *

Silage from sugar beet tops. M. E. MAWBY. *Sugar J.* (La.), 1963, **26**, (7), 82–83.—Successful feeding of ensilaged beet tops to cattle on an English farm is described with details of the procedure adopted by the farmer in building up the silage clamps.

* * *

The Puerto Rico rum pilot plant. J. B. MORA. *Sugar J.* (La.) 1963, **26**, (7), 84–86.—The rum pilot plant at Río Pedras is described. Intended as a research unit, the plant covers all phases of rum production from reception of the blackstrap molasses to the final rum after ageing. Experiments have been made with incremental fermentation, whereby 13% alcohol by volume is obtained at 86% efficiency in approximately 54–60 hr fermentation.

* * *

Sucroglycerides. B. LOISEAU. *Ann. Falsif.*, 1963, **56**, 221–224; through *S.I.A.*, 1963, **25**, Abs. 1034.—The preparation and properties of sucroglycerides, defined as a complex (mixture) of sucrose esters and mono- and di-glycerides, and the possible applications are briefly considered.

* * *

Active carbon from Indian lignite. II. Utilization of lignite dust for making a granular product. S. P. SEN, N. BHATTACHARYYA and K. R. CHAKRAVORTY. *Indian J. Technol.*, 1963, **1**, 240–243; through *S.I.A.*, 1963, **25**, Abs. 1043.—Carbons made from 1:1 up to 3:2 molasses-lignite blends were found to have higher mechanical strengths but, in general, lower absorptive capacities than those made from similar blends of $ZnCl_2$ and lignite. The effects of steam- and CO_2-activation on the yield, bulk density and absorptive capacity of each product were examined. The results are shown in graphs and tables.

* * *

Production of itaconic acid by fermentation of cane molasses. J. C. Y. TSAO and S. C. H. SU. *Sugar y Azúcar*, 1964, **59**, (1), 36–38, 48.—Submerged fermentation of molasses with *Aspergillus terreus* (NRRL 1960) gave much higher itaconic acid yields than did sucrose or glucose. Optimum conditions were found to be: pH 1·8 at 26 ± 3°C; a glucose content of 6% in the molasses; a fermentation period of 6 days; presence of magnesium and ammonium sulphate nutrients in concentrations of 1·0–2·5 g/litre and 1·5–2·0 g/litre, respectively, and prior treatment of the molasses with active carbon, bauxite and sulphuric acid to precipitate impurities, especially Ca^{++} ions. Molasses alone yielded 20·5 g of itaconic acid per litre while 6% glucose + 4 ml molasses/litre yielded 21·0 g/litre (compared with 9·12 and 4·975 g/litre using 6% glucose and 6% sucrose respectively).

* * *

Feed value of ammoniated pulp. S. SEIDLER. *Gaz. Cukr.*, **72**, 21–25.—Tests conducted on cattle fed with rations containing ammoniated pulp showed that roughage of high albumin content can be replaced by the pulp without any adverse effect on milk yields or meat production. Full details are tabulated.

* * *

Adding urea to molasses. W. STANKIEWICZ. *Gaz. Cukr.*, 1963, **71**, 220–222.—A unit for the production of ureated molasses at Szamotuly sugar factory is described and the economics briefly discussed. The total N content of the treated molasses is 4·7–7·6%.

* * *

Sugar utilization. C. R. BONATI. *Ind. Sacc. Ital.*, 1963, **56**, 167–172.—A review is presented of a number of papers concerned with the utilization of sugar and of sugar by-products.

* * *

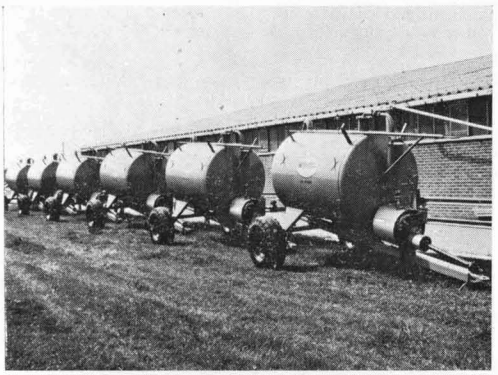
Recovery of yeast from the fermented musts in the alcohol factory. C. CARBAJAL. *Bol. Azuc. Mex.*, 1963, (173), 21–28.—The Boinot process as developed be Les Usines de Melle is described. By separating yeast from fermented must and re-using it with fresh must, it is possible to achieve 5% higher alcohol yield and also to obtain yeast which may be recovered and utilized for animal and human consumption. Advantages of yeast as a source of protein are discussed as are details of the process and its economics.

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.

British effluent tankers for Nigeria. Wright Rain Ltd., Crowe, Ringwood, Hants.

An order has been placed for the supply of seven special high-clearance Wright Rain "Manurain" tankers to Bookers (Nigeria) Ltd., to be used on their sugar cane estate at Bacita. The tankers, of 700 gallons capacity, are filled and emptied with a powerful



built-in combined vacuum/pressure pump, and will be used to spread filter cake and molasses slurry onto the land at Bacita. The tankers, which are operated from the towing tractor's power take-off, can be filled under vacuum in 3–5 minutes and towed to the field where the filter cake and molasses can be blasted out of the spreader attachment at the rear of the tanker under pressure, as a fine spray.

* * *

Sugar tipplers in Puerto Rico. Strachan & Henshaw Ltd., Ashton Works, P.O. Box 103, Bristol 3.

Two "Liftaside" tipplers for unloading sugar cane from railway wagons have been installed at the Aguirre, Puerto Rico, works of the Central Aguirre Sugar Company. The tipplers rotate wagons weighing up to 24 tons gross through 130° with a tip-and-return cycle time of two minutes.

Each "Liftaside" is rope-operated and consists of two L-shaped cradles, pivoted about ground mounted support pillars and carrying a pivoted rail table. A fixed side beam is attached to the cradles and is resiliently faced to support the wagon without damage.

The hoisting mechanism comprises two rope barrels, driven through enclosed gearing by a 60 h.p. electric motor. It is supported by an overhead steel structure which also carries the counterweight gear to operate the side clamps. These hold the wagon firmly in position, yet leave the top unobstructed, allowing free discharge of the cane ten feet above rail level on to a conveyor. The tipplers can handle wagons up to 30 ft 6 in long, 8 ft 7 in wide and 10 ft 9 in high.

* * *

"Jizer Safe-Flash" degreasing and cleaning solvent. Deb Chemical Proprietaries Ltd., Forfar Works, Spencer Rd., Belper, Derbyshire.

"Jizer Safe-Flash" is economical and efficient for degreasing a very wide variety of applications in the industrial field. It is non-acid, non-caustic and non-toxic. It can be used in perfect safety without any need for the introduction of special ventilation. It absorbs many times its own volume of oil and remains soluble in water.

It is suitable for engineering workshops, tank cleaning operations, etc. It will in addition clean ordinary workshop floors, paint brushes, oil cabinets, etc., and will be found suitable in any other superficial cleaning jobs.

Having a flash point of 170°F, its real use however lies in the elimination of fire risk from the hazardous use of low flash solvents, having particular application in welding shops, boiler houses and similar places where dangerous fumes can be ignited to cause explosion and fire.

PUBLICATIONS RECEIVED

"AUTOANALYZER NEWSLETTER." Technicon Instruments Co. Ltd., Hanworth Lane, Chertsey, Surrey.

The "AutoAnalyzer" is an automated chemical analytical system with many and varied fields of application, including sugar and amino-acid chromatography, water chemistry and pollution analysis, chemical process control, etc. This newsletter has been introduced by the manufacturers and provides new information on automated techniques, the first issue dealing with new apparatus for u.v. analysis, continuous fluorimetry, and a new sampler, new techniques for amino-acid chromatography, fermentation control, soil cation and P analysis, and automatic digestion for protein bound iodine assay, colorimeter-recorder systems, a number of new biochemical methods and recent publications concerned with automatic analysis using the "AutoAnalyzer".

* * *

TEST SIEVING MANUAL.. Endecotts (Filters) Ltd., Lombard Rd., London S.W.19.

This work, produced by a manufacturer of test sieves and sieve shaking machines, is nevertheless a most useful handbook containing basic information for the ordinary user of this equipment. It contains a certain amount of advertising, including a catalogue section giving details of the products of Endecotts (Filters) Ltd., but most of the work is devoted to the scope and techniques of sieving, with chapters discussing sampling, data analysis and definition of particle size. A number of tables of British, U.S., French and German Standard sieve sizes are given as well as graphs of various types used to evaluate the analyses.

* * *

SPHERICAL ROLLER BEARING. Link-Belt Company, Prudential Plaza, Chicago, Ill., 60601 U.S.A.

A newly designed series of spherical roller bearings, No. 22400, has load ratings higher by an average of 54% than the series 400 concave roller bearings which it replaces. The bearings require less torque, are quieter and will operate at much higher speeds. They are described in Book 2920 which provides dimensions, selection methods and load ratings, as well as the three types of "Impervron" seals for the use with the series. The bearings come in 2- or 4-bolt pillow blocks, flanged blocks, cartridge blocks, flanged cartridge blocks and take-up blocks, as well as in unmounted units.

* * *

CATALOGUE NUMBER EIGHT 1964. Mechanical Handling Engineers' Association, Glen House, Stag Place, London S.W.1.

No less than 105 photographs are presented on various aspects of mechanical handling, the equipment illustrated being products of members of the Association, which this year celebrates its 25th Anniversary. The 105 are divided into seven sections dealing, respectively, with conveyors and elevators, portable conveyors, transporters, skip hoists and telphers, drag scrapers, ropeways and cableways, pneumatic handling, and wagon tipplers and marshalling plant. A separate section lists all the members of the Association, their addresses, etc., and an indication of the products they make, classified as above.

* * *

UTILIZATION OF BAGASSE. Maschinenfabrik Buckau R. Wolf AG., Grevenbroich, Germany.

This new booklet describes the possibility of utilizing bagasse other than as a fuel, i.e. in the manufacture of particle boards, dry- and wet-process moulded objects, cellulose and paper. In the supply of plant for production of particle boards, Buckau R. Wolf AG. have cooperated with the Himmelheber group which has great experience in this field. Their Formosa plant has a capacity of 90 cu.m. of board per day (in 4 ft × 12 ft sheets), while a plant on Okinawa has a capacity of 100 cu.m. per day. Very strong hydraulically-pressed containers are made by the "Collipress" process using bagasse fibres and binders in the dry process, while moulded containers, chair seats, radio, car and television parts may be made using the wet process, equipment for which is also available. Finally a flow sheet for production of semi-cellulose, paper or cardboard from bagasse is presented with a description and layout indicating the various mechanical and chemical means of converting bagasse into paper pulp.

* * *

LABORATORY pH METER. W. G. Pye & Co. Ltd., P.O. Box 60, Cambridge, England.

This new meter has a range of 0 to 14 pH with a meter zero at 7 pH. Alternatively it may be used as a millivoltmeter for the range + to — 350 mV. Its scale is 7½ inches long, and calibration accuracy is 0·3% f.s.d. Power consumption is approx. 16 watts and the instrument has facilities for both automatic and manual temperature correction from 0 to 100°C. It measures approx. 9½ × 11 × 9 inches, and weighs 21 lb.

* * *

THE SIMON-CUSI PULPING PROCESS. Simon Handling Engineers Ltd., Stockport, England.

This new booklet, available in English and Spanish, describes the pulping process applicable to bagasse among other materials, which was developed by Dr. D. S. Cusi of San Cristóbal, Mexico. It involves dry and wet de-pithing, dewatering and then soaking in cooking chemical and pressing; this is followed by high-consistency cooking when the resultant semi-pulp is fractionated, the coarse fraction being defiberized and digested again. The fractions can be treated separately to give different products or can be combined.

* * *

ZUCKERFABRIK KERMANSHAH. Salzgitter Maschinen A.G., 3327 Salzgitter-Bad, Postfach 23, Germany.

This well-illustrated report (to be available shortly in English) has been prepared in conjunction with the erection of the white sugar factory at Kermanshah, Iran. With a daily slice of 1000 tons of beet (later to be increased to 1500 tons), the factory was completed in 8½ months and was able to start operations at the end of 1963. Most of the equipment (carbonatation plant, triple-evaporator, 3-product pans) is made by Salzgitter, but a DdS 1500-ton diffuser is also incorporated. Details are given of the water supply and steam economy at the factory.

* * *

£400,000 order for Fletcher & Stewart Ltd.—The order for the new milling plant at Ingenio Riopaila, Colombia, South America, together with a considerable amount of other equipment, has been secured by Fletcher & Stewart Ltd., of Derby and Glasgow. Replacing an existing plant, the new tandem is to have 6 mills with rollers 45 × 84 in and a crushing capacity of 4000 metric tons per day of 24 hours in the initial stage of expansion. It is intended eventually to increase to 7000 tons per day. Ingenio Riopaila is one of the Caicedo Group of factories in the Cauca Valley and in addition to the milling plant a large amount of process equipment is also being supplied. This is in line with the Colombia Government's scheme to increase sugar production and from Fletcher & Stewart's point of view is a further extension to their already active market in the Latin American countries.

* * *

Cane harvesters for Puerto Rico.—Two new second generation Duncan cut-load sugar cane harvesters have successfully completed the first season of operation in Puerto Rico and orders have been placed for additional machines for 1965. These are production prototypes, and have evolved through knowledge gained with earlier models; they are cut-load in operation, pick up and cut heavy down and lodged cane, and have greatly increased cutting rates. All major features of the machines have been used in previous commercial harvesters. Rugged construction and a cutting rate of some two tons per minute are features of the new machines. The harvesters were designed for International Cane Machinery Corp., P.O. Box 4034, Honolulu, Hawaii 96812, by R. A. Duncan, who for 13 years was chief engineer of the Hawaiian Sugar Planters' Association Experiment Station.

World Net Import Requirements 1964

International Sugar Council 3rd Estimate[1]

Country or Area	*metric tons, raw value*
A. FREE MARKET	
EUROPE	
Albania	7,000
Cyprus	15,000
Finland	160,000
Germany (West)	65,000
Gibraltar	4,500
Greece	80,000
Iceland	8,000
Ireland	12,000
Italy	350,000
Malta	15,500
Netherlands	240,000
Norway	160,000
Portugal (incl. territories)	70,000
Spain (incl. territories)	300,000
Sweden	108,000
Switzerland	200,000
United Kingdom	2,050,000
U.S.S.R.	1,900,000
Yugoslavia	70,000
TOTAL	5,815,000
NORTH AMERICA	
Canada	715,000
TOTAL	715,000
CENTRAL AMERICA	
Bahamas and Bermuda	6,000
Honduras	2,000
Panama Canal Zone	5,000
Virgin Islands (U.K.)	400
TOTAL	13,400
SOUTH AMERICA	
Chile	175,000
Uruguay	60,000
TOTAL	235,000
ASIA	
Afghanistan	38,000
Arabian Peninsular:	
Aden, Colony & Protectorate	30,000
Saudi Arabia & Red Sea and Persian Gulf Territories	100,000
Brunei	3,000
Burma	30,000
Cambodia	15,000
Ceylon	203,000
China (Mainland)	520,000
Hong Kong	72,000
Iran	250,000
Iraq	225,000
Israel	80,000
Japan	1,280,000
Jordan	45,000
Korea (North)	25,000
Korea (South)	50,000
Laos	3,000
Lebanon	30,000
Malaysia: Malaya	200,000
Sabah	12,000
Sarawak	18,000
Singapore	75,000
Mongolia	20,000
Nepal	4,500
Syria	80,000
Vietnam (North)	20,000
Vietnam (South)	70,000
TOTAL	3,498,500
AFRICA	
Algeria	250,000
Cameroon	10,000
Central African Republic	3,000
Chad	16,000
Dahomey	9,000
Gabon	1,000
Gambia	3,000
Ghana	50,000
Guinea	10,000
Ivory Coast	35,000
Kenya	55,000
Liberia	6,000
Libya	27,000
Mali	27,000
Mauretania	22,000
Morocco	440,000
Niger	9,000
Nigeria	70,000
Senegal	65,000
Sierra Leone	15,000
Somalia	31,000
Sudan	120,000
Togo	5,000
Tunisia	80,000
Upper Volta	6,000
U.A.R. (Egypt)	80,000
Zanzibar & Pemba	6,500
TOTAL	1,451,500
OCEANIA	
New Zealand	120,000
U.K. Admin. Oceania	2,500
U.S. Admin. Oceania	4,000
Western Samoa	2,800
TOTAL	129,300
TOTAL FREE MARKET	11,857,700
B. U.S. MARKET	
U.S.A. net import requirements from foreign countries	3,266,000
C. GRAND TOTAL	15,123,700
GRAND TOTAL ROUNDED	15,125,000

NOTE: Import requirements of African countries appearing for the first time in this estimate were treated as internal movements in November. The third estimate takes account of the change in the coverage of the French signature to the Agreement which implies that all imports by and exports to these countries are now free market trade.

Bulk handling in Trinidad.—It is reported[2] that Caroni Ltd. is to set up a bulk raw sugar shipping installation at Point Lisas, the port already used by Federation Chemicals Ltd. The new sugar installation will include a 20,000-ton storage warehouse with weighing equipment and a conveyor for loading bulk sugar direct from warehouse to ship. This new installation will replace the existing shipping port of Goodrich Bay and is expected to come into operation in mid-1965. The total cost is reported to be approximately $3,000,000 (£625,000).

* * *

New sugar factory for Colombia[3].—A new company, Azúcares del Oriente, which is to install a sugar mill in the Department of Santander, was recently established in Bucaramanga.

[1] Dated 15th June 1964; see *I.S.J.*, 1964, **66**, 209.
[2] *Overseas Review* (Barclays D.C.O.), June 1964, p. 67.
[3] *Fortnightly Review* (Bank of London & S. America Ltd.), 1964, **29**, 450.

BREVITIES

C.I.T.S. Proceedings.—The Proceedings of the 12th General Assembly of the Commission Internationale Technique de Sucrerie which was held in Paris in June 1963[1] has been published. The Assembly was attended by more than 140 persons from 20 countries. The Proceedings contains the text of the 29 papers presented, together with the discussions which followed them, and comprises 540 pages with 148 tables and 120 illustrations. Copies are available from the General Secretary of the C.I.T.S., Dr. J. HENRY, at 1 rue Aendoren, Tirlemont, Belgium, the cost being 600 Belgian francs which should be paid to C.C.P. 18180 of the "Caisse Tirlemontoise de Depôts", Account C.I.T.S. No. 106, specifying the object of the transfer.

* * *

The cane-banana rotation.—This simple rotation, first extensively practised at Caymanas Estates, has been described by H. W. PAYNE in "Soil and Water Conservation", edited by G. W. MORGAN and published by the Ministry of Agriculture and Lands, Jamaica. When the yield from one crop has become uneconomical the area is turned over to the other crop. This rotation has gained much popularity of recent years because it controls the banana root rot nematode. It is recommended for well drained soils, particularly the very fertile recent alluvials in Jamaica, but only in areas where both crops have been found to be commercial ventures.

* * *

New sugar factories for Russia[2].—Three new plants are under construction in the Lipezk-Tambov-Kursk area, where there are already 38 sugar factories in operation, supplying about half of the total sugar production of the R.S.F.S.R. The new factories will be the biggest in the Soviet Union.

Stock Exchange Quotations

CLOSING MIDDLE

London Stocks (*at 17th July* 1964)	s d
Anglo-Ceylon (5s)	9/4½
Antigua Sugar Factory (£1)	14/–
Booker Bros. (10s)	19/–
British Sugar Corp. Ltd. (£1)	33/10½
Caroni Ord. (2s)	3/9
Caroni 6% Cum. Pref. (£1)	15/9
Demerara Co. (Holdings) Ltd.	5/3
Distillers Co. Ltd. (10s units)	27/10½
Gledhow Chaka's Kraal (R1)	27/3
Hulett & Sons (R1)	42/–
Jamaica Sugar Estates Ltd. (5s units)	5/7½
Leach's Argentine (10s units)	19/4½
Manbré & Garton Ltd. (10s)	35/–
Reynolds Bros. (R1)	21/6
St. Kitts (London) Ltd. (£1)	20/9
Sena Sugar Estates Ltd. (10s)	7/9
Tate & Lyle Ltd. (£1)	36 7½
Trinidad Sugar (5s stock units)	3/5¼
United Mŏlasses (10s stock units)	34/–
West Indies Sugar Co. Ltd. (£1)	17/–

CLOSING MIDDLE

New York Stocks (*at 16th July* 1964)	$
American Crystal ($10)	19⅞
Amer. Sugar Ref. Co. ($12.50)	19⅞
Central Aguirre ($5)	27
North American Ind. ($10)	35¾
Great Western Sugar Co.	15½
South P.R. Sugar Co.	32½
United Fruit Co.	22½

Demerara Co. (Holdings) Ltd., 1963 report.—Combined production of Plantations Diamond and Leonora was a record, at 63,102 tons in 1963 compared with 58,808 tons in 1962 and 59,506 tons in 1961. In consequence of the high world price of sugar, profits rose steeply. Production outlook in 1964 is unclear because of the unrest in British Guiana, and a very severe drought has not only curtailed the spring crop but may well prove to have damaged the autumn crop to some extent. Contracts have been signed for the replacement of the two existing tandems at Diamond by a new Fletcher & Stewart mill; this will have five 3-roll units with a capacity of 150 t.c.h. and will be driven by Weir steam turbines.

* * *

Sugar production in Argentina[3].—The total cane crop in Argentina in 1963 amounted to 11,075,900 metric tons, of which 4,178,676 tons was estate cane and 6,897,224 tons bought cane. Sugar production amounted to 990,391 tons, compared with 735,656 tons in 1962, made from 9,005,962 tons of cane.

* * *

Sugar industry for Algeria[4].—The first sugar factory in Algeria is to be constructed this year at Affreville. It will start to operate in 1965, serving as a pilot plant for further factories. Its production, with that of the Guelma sugar factory, to be built in 1966, and three other factories will supply 45,000 tons of sugar to the Algerian market or a little less than a quarter of the annual consumption. The new plants are expected to start with 50-day campaigns before they achieve seasons of normal length—100 days. They will be equipped for refining of imported raw sugar.

* * *

Portuguese sugar imports[5].—Imports of sugar into Portugal during 1963 totalled 155,940 metric tons, of which 27,146 tons came from Angola, 120,192 tons from Mozambique, 8329 tons from Brazil and 273 from other countries. In 1962, of the total imports of 165,138 tons, 36,630 tons came from Angola, 107,126 tons from Mozambique, 20,923 tons from Brazil, and 459 tons from other countries.

* * *

New sugar factory for Louisiana[6].—Construction is under way on a new raw sugar mill to be built by Reserve Sugar Co. about a mile from the Godchaux refinery at Reserve, Louisiana. The new mill has contracts for the cane from 5500 acres and is expected to start crushing in October 1964.

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Bagasse paper possibliities in Argentina[7].—Thirteen sugar factories in the province of Tucumán are to be connected with the State gas network and will use gas for combustion in their furnaces. The gas will displace fuel oil, wood and bagasse fuels; the last may be used for the preparation of paper, studies being currently made at Ingenio La Florida to this end.

* * *

Philippines sugar crop forecast[8].—Revised estimates for the current harvest in the Philippines total 2,017,497 short tons, exceeding the 1962/63 crop by 303,592 tons and establishing a record by breaking through the 2 million ton mark for the first time.

* * *

Bagasse building material in Barbados[9].—Construction of the factory at Fairfield, St. Lucy, Barbados, by Caribbean Enterprises Ltd. to manufacture building material from local bagasse fibre and stone is nearing completion and operations are expected to commence as soon as the necessary machinery is installed.

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[1] *I.S.J.*, 1963, **65**, 229–230.
[2] F. O. Licht, *International Sugar Rpt.*, 1964, **96**, (15), 12.
[3] *La Ind. Azuc.*, 1964, **69**, 15–17.
[4] *Sucr. Franç.*, 1964, **105**, 78.
[5] F. O. Licht, *International Sugar Rpt.*, 1964, **96**, (8), 13.
[6] *Sugar y Azúcar*, 1964, **69**, (5), 76.
[7] *La Ind. Azuc.*, 1964, **69**. 27.
[8] *Sugar News* (Philippines), 1964, **40**, 137.
[9] *Overseas Review* (Barclays D.C.O.), March 1964, p. 70.