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NOTES AND COMMENTS

I.S.J. Panel of Referees.

Dr. LEONARD D. BAVER, who has served as a member of our Panel of Referees since 1956, has advised us of his departure from the Hawaiian sugar industry, where he has been with the H.S.P.A. Experiment Station as Director from 1948 to 1963 and subsequently as Director Emeritus and Consulting Scientist. Dr. BAVER has accepted the Chair of Agronomy in the Ohio State University and will also be Chief of Party in the University's A.I.D. Contract at the University of Udaipur, Rajasthan, India, where he will also be Advisor to the Vice-Chancellor. Udaipur is one of the seven Agricultural Universities established in 1962 in cooperation with five Land-Grant Colleges of the U.S.A. under the A.I.D. programme. We would like to take the opportunity of thanking Dr. BAVER for his work as a Referee on our behalf during the past 9 years, and to offer our best wishes for continued success in his resumed academic career.

DR. DOUWES DEKKER

We are pleased to announce that Dr. K. DOUWES DEKKER has agreed to serve on the Panel. After obtaining his Doctorate from the University of Utrecht in 1927 Dr. DOUWES DEKKER joined the Proefstation voor de Java Suikerindustrie at Pasuruan, Java, as a research chemist, subsequently serving in various capacities. He was a prisoner of war during the Japanese occupation of Java in 1942-45 and in 1947 resigned to join the Centrale Suiker Mij. in Holland as adjunct director of Steenbergen beet sugar factory. In 1948 he was appointed the first Director of the Sugar Milling Research Institute in Durban, Natal, the work of which has achieved due acclaim in the technical literature of the sugar industry.

Dr. DOUWES DEKKER has contributed many papers to the *Archief voor de Java Suikerindustrie*, to the *Proceedings* of the South African and International Societies of Sugar Cane Technologists, and he is a vice-president of I.C.U.M.S.A. and referee for Subject 16: Ash. He contributed two chapters to Honig's "Principles of Sugar Technology", and possesses a great depth of experience and judgment in sugar topics. We thank him for permitting us to have the benefit of this experience for evaluating manuscripts submitted to this *Journal* for publication.

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International Sugar Conference.

The International Sugar Conference organized under the auspices of the United Nations opened in Geneva on the 20th September, with invitations to 124 countries—all members of the United Nations Conference on Trade and Development (UNCTAD). Thus, Rhodesia, East Germany, Mainland China, North Korea and North Vietnam, who are not members of UNCTAD, have been excluded. The basis for negotiations will be a 73-article draft of a new Agreement submitted to the Conference by the Executive Director of the International Sugar Council, Mr. E. JONES PARRY.

It is understood that the draft will provide for export quotas, remunerative prices for producers and for contracts at these prices between importers and exporters. It will also suggest measures to help developing countries hold stocks at harvest times when prices tend to sag.

F. O. Licht K.G., in a special issue of the *International Sugar Report* on the possibility of improving the world sugar market situation by a new Agreement, note: "Up to now the fixation of export quotas has been the main question of the negotiations at International Sugar Conferences. Each delegation has been eager to receive an export quota as high as possible. Because the success of the agreement depended partly on the membership of all important exporting countries, the conference has always agreed to these exaggerated claims for export quotas. In this respect the International Sugar Conference in Geneva will have to face much greater difficulties, because the supply situation on the free world sugar market has meanwhile considerably changed. In particular, developments in Cuba have led to a changed situation because several countries are supplying sugar to those territories which were formerly supplied with Cuban sugar. The most important outlets for Cuban sugar were the United States and Japan. These two countries, which before the Cuban revolution imported sugar mainly from Cuba, are supplied today by numerous Central and South American countries as well as by Australia, the South African Republic, India and other countries.

"Certainly the countries which had quotas under the former International Sugar Agreement will claim the same or higher quotas in a new agreement. On the other hand, the new exporting countries will certainly not renounce the new markets. Therefore there is again a danger that the claims for export quotas will exceed the requirements and that the disproportion between supply and demand will not be prevented. Whether there will also be political antagonism in this Conference will not be discussed in this article. If, however, there is no will for co-operation also of the different political groups, the negotiations will certainly end in failure".

Licht thinks that, for a new Agreement to be effective, "the most important condition is the adaptation of production to the outlets. All quotas and other limitations will not have any effect on prices if sugar stocks exceed a normal level . . . The fixation of too high export tonnages could lose its danger only if the International Sugar Council would have the necessary power to adapt the offer on the free world market by a reduction of exporting quotas to the outlets. In this case the International Sugar Council would receive extraordinary power. Here, however, arises the question whether the exporting countries will be ready to delegate such a power and whether they will be sufficiently disciplined to follow the necessary measures of the International Sugar Council . . . However, without adaptation of production to the outlets, without limitation of export quotas, without participation of all important exporting countries and without corresponding powers for the International Sugar Council, the conclusion of an International Sugar Agreement would be useless".

European sugar beet area estimates.

F. O. Licht K.G. recently issued their revised estimates of the 1965 sugar beet area in Europe[1]. Details appear elsewhere in this issue together with the first estimates, issued in April, and the actual figures for 1964 and 1963. The total change amounts to something over 70,000 hectares or about 1% less than the original estimates, and is the net effect of a number of increases (in Western Germany, France and Italy) and decreases, the latter being due in many cases to the poor weather experienced at planting time in the countries concerned. The figure for the U.S.S.R. is unaltered from the earlier estimate; at 4,200,000 hectares, even a small percentage change could mean a considerable difference in the total number of hectares, but in the absence of information from the Soviet Union on the progress of the 1965 beet crop, the figure adopted is left unchanged at the official figure given for 1964.

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Colonial Sugar Refining Co. Ltd. 1964/65 report.

The reduction in profit for the Company in 1964/65 is wholly attributable to raw sugar milling in Australia and Fiji and is the effect of low sugar prices and of disappointing production caused by adverse seasonal conditions. The mills in Australia and Fiji produced 697,000 tons of sugar in the 1964 season; while this was better than the output in 1963 it was less, by the large amount of 71,000 tons, than forecast for the 1964 season in June 1964. For the 1965 season the present milling estimates indicate that raw sugar production will be somewhat higher at 735,000 tons than from the previous crop but, because of unfavourable weather conditions, it will fall well short of the planned tonnage and of earlier expectations for the year.

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Cuban sugar production, 1965[2].

The National Crop Organizing Commission has provided the following information: The "Frank Pais" sugar mill finished its crop on 30th June of this year and was the last mill to do so. The crop in 1965 was 6,050,532 metric tons of sugar. The situation by provinces pertaining to the 1965 crop, in relation to the 1963 and 1964 crops, is as follows:

		(*metric tons*)	
Provinces:	1963	1964	1965
Pinar del Rio	158,548	162,756	203,636
Havana	297,294	346,799	409,521
Matanzas	421,811	513,030	651,376
Las Villas	918,537	1,019,833	1,358,744
Camagüey.....	874,347	908,855	1,467,350
Oriente	1,211,987	1,446,508	1,959,905
Total	3,882,524	4,397,781	6,050,532
Total (long tons) ..	3,821,166	4,328,280	5,954,912

Production in the 1965 sugar crop represents an increase of 55·8% over the 1963 crop and 37·6% over the 1964 crop.

[1] *International Sugar Rpt.*, 1965, **97**, (21), 1.
[2] *Willett & Gray*, 1965, **89**, 300.

OBJECTIVES IN CANE VARIETY BREEDING, SELECTION AND EXPERIMENTATION

By Dr. WILLIAM E. CROSS

WHEN the Tucumán Experiment Station began its work with cane varieties in 1910, its aim was simply to discover more productive and sweeter canes than the "native" purple and striped varieties which until then had formed the basis of the industry in the Argentine. The experimental work was carried out in the Station plots, and also in six sub-stations which were located in different representative zones of the Province. By 1913 it had been shown that certain POJ canes, Nos. 36, 213 and 234, gave the best results, and seed cane of these varieties was distributed, to try out, among a number of planters in different parts of the Province. When the mosaic disease struck this country with great virulence in 1915–16, by lucky chance these canes turned out to be tolerant to it in a high degree, so that within two or three years all the cane fields of the Argentine were planted with them, with such excellent results that within a few years more there occurred a crisis of over-production.

As the experimental work developed, the few comparatively simple objectives of those early years were greatly increased, and the work became much more complicated, including many additional objectives. The most important of these were the following:

rapid and abundant germination, as plant and stubble,

abundant stooling,

rapid growth, covering the middles quickly, making the cultivation more economical,

upright manner of growth, without reclining, and without "falling" when exposed to strong winds,

stalks of good thickness, with no tendency to sprout from the side buds,

freedom from fine spines on the leaves, leaf-sheaths, and tops, which do harm to the cane-cutters by irritating and wounding their skin and by polluting the air which they breathe,

maximum response to fertilizers,

resistance to drought,

resistance to excess of moisture in the soil, flooding, etc.,

resistance to frost,

immunity or high degree of resistance or tolerance to the diseases and insect pests existent in this country,

lack of tendency to flower during the harvest season,

early ripening,

ease of harvesting and stripping,

good ratooning, with high yields of stubble cane during six to eight years, even when cut early in the harvesting season,

moderate fibre content both as plant and stubble, neither very low (less than 10·5%) nor too high (over 13·5%),

good milling qualities, giving high extractions, of juice which is easy to clarify, settle, decant and filter, and producing white sugar of good quality, with a low proportion of well-exhausted molasses, and

adaptability to being left standing in the field in one harvesting season, to be cropped in the following year.

The varieties included in the experiments were not only those we imported, and the seedling canes we ourselves produced, but also mutations, or "sports" of some of our good varieties, which we were able to obtain by studying very large numbers of stools and stalks of each one, in an endeavour to find canes which differed from the usual ones of each variety, in some characteristics, especially in the colour of the stalk, as we had found that these differences were accompanied by changes in the productivity and in the composition of the cane. Thus we found a red sport of POJ 36 which is definitely more productive than the common cane of this variety, although it is somewhat less rich in sugar, and also a striped sport of the same cane, which is definitely sweeter than the usual POJ 36, but less productive in cane per acre. Working with other varieties, we discovered striped, red and white sports of POJ 213, white and striped sports of Tuc. 385, white and striped sports of Kassoer, and a striped sport of POJ 2725, all of which differed significantly from the common cane of the corresponding variety, either in productivity or in sugar content. Owing to the termination of my contract with the Experiment Station I was unable to pursue this work further, although I had the satisfaction of knowing that three sports of POJ 36 and one of POJ 213 became cultivated by the planters on a commercial scale.

(I was sorry to have to give up this work, as I am convinced that by carrying out the studies on a sufficiently large scale, valuable commercial canes could be obtained. Up to now the only characteristic upon which the search for mutations has been based, both here and in other countries, as far as I know, is that of the colour of the canes, and the only objectives looked for, those of productivity and sweetness; but there could be included many other characteristics and objectives. For example, of the former, canes with peculiarities in the buds, the leaves or leaf-sheaths, or those of a special vigour of growth, exceptional length or thickness of stalk, or stools of unusual resistance to drought, frost, or diseases; and of the latter, any of the qualities which constitute the objectives of the research. This work differs from that of breeding and selecting new varieties—of which the

very great majority turn out to be of no value—in that it is based on varieties of already established merit, which it is sought to improve by discovering mutations of same. It is admitted that the work of searching for the apparent mutations, and that of planting and replanting them during various "generations", to obtain the pure strains, is considerable, but the possible value of the results is great.)

The work of studying all our varieties in respect of all these different objectives was arduous, but most of the canes we came to recommend attained them to an acceptable degree.

In 1941 cane smut appeared in the Argentine, and in the next two years spread over the whole cane area, attacking in a virulent degree the cane of nearly all the varieties commercially cultivated, especially POJ 36 and POJ 213 and their mutations, and Tuc. 472 and Tuc. 1376, and producing a very serious production crisis in the industry. Our chief objective in the variety work had to become that of discovering canes which were resistant to the disease. In this we had great success, as we found that certain of the most productive Tucumán seedling varieties, such as numbers 2645, 2680, 2683, 3342 and 4441, and also some of the imported canes, such as Co. 290 and POJ 2725, were not only resistant but practically immune to the smut, thus providing a perfect solution to the crisis, as these varieties were used to replant the cane fields, with such success that in 1946 a record crop of sugar was obtained.

In view of this satisfactory result, it occurred to me that by means of this variety work, carried on intensively and on a sufficiently large scale, a similar perfect solution could be obtained to other serious problems which affect the sugar industry in many countries, causing almost incalculable losses, which up to now have remained unsolved. One of the most important of these is that of the loss of sugar in the cane that is produced between cutting and milling, by inversion. Of course the obvious way of preventing this loss would be by organizing the harvest in such a way that all the cane is ground within a few hours of cutting, but we fear that this is achieved in very few places, especially in the case of that produced by the independent growers. In Tucumán it is calculated that on the average the cane milled has been cut at least five days, and there is evidence in the technical literature that similar delays occur with much of the cane milled in many other countries. And when it is considered that, according to Tucumán results, such delays may easily cause a reduction of the factory yield of sugar, of some twenty pounds per ton of cane milled, it is clear that the losses incurred each year in the sugar industry of the world amount to an almost astronomical sum of money.

Therefore, as there would appear to be no hope of preventing these losses by the avoidance of all delays between cutting and milling, it would be strongly advisable to include among the objectives of the work of breeding and selection of cane varieties, that of discovering canes which do not suffer an appreciable degree of inversion of the sucrose after cutting. That this could be achieved would appear to be indicated by the fact that we already have some varieties which have this characteristic, especially the old "native" purple and striped canes (which could be left in the fields after cutting for many days without suffering an appreciable loss in their sugar content, which frequently even increased considerably, owing to the concentration of the juice produced by drying out of the cane). Similar properties were also shown to a lesser degree, by POJ 2725, Co 281, CP 29-116, CP 36-13, Tuc. 2692 and some others, although they do not have all the other qualities which are desirable in canes for commercial cultivation, at least in Argentina. But at all events their existence would serve to indicate the practicability of achieving in this way the perfect solution to this problem.

Two other problems which have hitherto defied all attempts to find a really satisfactory solution are connected with the mechanical harvesting of the cane: the obtaining of clean, properly stripped cane for the mill, and the "topping" of the cane so as to discard the immature part, without sacrificing any ripe joints. For the harvesting machines in use do not strip the cane, and the elimination of the leaves and leaf-sheaths by burning is never more than partially successful, so that the cane which goes to the mill usually carries a considerable proportion of trash, which gives rise to losses which have been described as "tremendous". And the topping devices with which the machines are provided are adjusted for each field in accordance with the average height of the cane, but as the stalks usually vary considerably in length, the longer stalks will be "topped" too low, and the shorter ones will be left with some green joints still on them.

We believe that the problem of obtaining cleanly stripped cane for the mill, even with mechanical harvesting, could be solved by including among the objectives of cane variety production and selection, that of finding canes which would be self-stripping, shedding all their leaves and leaf-sheaths during the ripening process, so that at the time of harvest the standing stalks would be practically bare, except at the top, where tufts of green leaves would remain. That such canes could be obtained is shown by the fact that, in our studies of the several thousand seedling varieties we produced in the Tucumán Experiment Station, we noticed that a small number of them, especially Tuc. 4702, were "self-stripping" in a notable degree, so that at harvest time the stalks were bare, with their tufts of green leaves at the top, reminding one of the pictures in the old cane books of cane which had been submitted to the general practice of that time in certain countries, of "trashing" the cane, i.e. stripping it by hand as it approached maturity, with the idea of accelerating the process of ripening. (Unfortunately, we did not attach any particular importance to this characteristic at that time, as in the Tucumán industry all the cane harvested was well stripped by hand by the

workmen, so that a "self-stripping" variety would at most have only served to lighten the task of the cutters.)

The problem of avoiding losses by the improper "topping" of the cane could in my opinion be solved by including among the objectives of the variety production and selection, that of discovering canes which have the habit of producing stalks of very uniform growth, and also that of ripening uniformly, practically up to the last joint. My belief is founded upon the fact that in my work with a large number of varieties, I found that there are some whose stalks are practically all of the same length, and that there is considerable variation in the degree to which the ripening extends to the higher joints, and also that in some varieties these are very much less unripe than in the usual run of canes.

It is evident that to discover the perfect solutions to these problems by including them among the objectives of the work of breeding and selection of cane varieties, it would be necessary to carry out the work on a very large scale, with abundant financial resources, exceeding anything which has been done thus far in the industry. But whatever it cost it would be more than justified by the enormous benefits which would accrue to the industry from the obtaining of varieties which suffer no loss of sugar between cutting and milling, and which ensure the milling of clean cane, properly "topped", even with the use of mechanical harvesters.

AGRICULTURAL ABSTRACTS

Some sugar cane pests and guides on their control. ANON. *Sugarland* (Philippines), 1964, **1,** (7), 31–35. This article, well illustrated with drawings, describes the worst cane pests in the Philippines, which include various borers, woolly aphis and rats.

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Lowering the cost of hauling sugar cane. ANON. *Sugarland* (Philippines), 1964, **1,** (7), 52–53.—A new tractor-drawn 5-ton trailer for cane haulage in the Philippines is here described. It is to be known as the P 12-50 Multi-Purpose Trailer and is produced by International Harvester Macleod Inc. It has a 68-inch wheel tread, 33-inch wheel base, allowing short radius curves on farm roads, and a 13-inch ground axle clearance.

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To treat or not to treat. G. M. THOMSON. *S. African Sugar J.*, 1964, **48,** 729.—The advantages of heat treated setts for controlling ratoon stunting disease and of maintaining seed beds or nurseries for lessening the effects of mosaic and other diseases is stressed. In one experiment the average decrease in yield due to mosaic disease was 82% (over 3 crops) while ratoon stunting disease caused a loss of 72%.

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Liquid nitrogen fertilizers. ANON. *S. African Sugar J.*, 1964, **48,** 733–735.—A series of experiments being conducted by a chemical firm on 5 or 6 sugar estates, in 50–100 acre fields, are referred to. Nitrogen is being applied in liquid form as ammonium hydroxide solution ("aqua ammonia"). Fields that have been burned, i.e. without a trash blanket, are used. The possibility of applying the gaseous form of anhydrous ammonia directly to the soil may also be explored.

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Sugar cane breeding in Argentina. ANON. *La Ind. Azuc.*, 1964, **70,** 311–313.—An account is given of the sugar cane breeding work accomplished at the Chacra experiment station in northern Argentina (Santa Rosa, Salta) since its establishment 12 years ago.

The challenges of an expanding beet sugar industry. G. D. MANUEL. *J. Amer. Soc. Sugar Beet Tech.*, 1964, **13,** 9–12.—In spite of wide mechanization the writer urges improvement in trash separation and topping. Years ago curly top and leaf spot were to the fore among diseases. Today it is virus yellows which must be controlled.

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Nitrogen effects on sugar crops. L. D. BAVER. *J. Amer. Soc. Sugar Beet Tech.*, 1964, **13,** 21–26.—The similarity between sugar beet and sugar cane in their behaviour to N fertilization is discussed. It is pointed out that N is the major factor affecting quality of sugar crops over which man has control. "Experience in both the beet and cane fields, as well as in the experimental plots, has shown that man has not been doing too good a job exercising this control."

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Isolates of beet mosaic virus with different degrees of virulence. C. W. BENNETT. *J. Amer. Soc. Sugar Beet Tech.*, 1964, **13,** 27–32.—This study was initiated on account of greater prevalence of sugar beet mosaic in California and the suspicion that more virulent strains of the virus may have become established. This proved to be so. The strains in question are described.

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Marble leaf of sugar beet, caused by a juice-transmissible virus. C. W. BENNETT. *J. Amer. Soc. Sugar Beet Tech.*, 1964, **13,** 33–41.—A "new" disease for sugar beet, with limited distribution and not known to be causing measurable loss, is described. Certain weeds (species of *Chenopodium* and *Atriplex*) are known to be alternative host plants.

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Beet leafhopper and curly-top disease in Washakie County. D. FULLERTON. *J. Amer. Soc. Sugar Beet Tech.*, 1964, **13,** 62–67.—A survey was conducted to determine the extent of curly-top infection and to find out more about the habits of the beet leafhopper (*Circulifer tenellus*). The first beet leafhoppers were found in July, 3 weeks after the first symptoms of curly-top appeared.

SUGAR CANE IN SOUTH AFRICA

Annual Report, 1963-64, of the Experiment Station of the South African Sugar Association.

IN his opening remarks the Director expressed the view that the sugar industry is standing on the threshold of new and possibly extensive expansion in hitherto unproved areas, at a time when the future prosperity of the industry may depend upon its ability to compete in increasingly competitive markets overseas. He also stated that "the need to intensify methods of producing sugar cane in South Africa is becoming increasingly apparent. There is, however, little doubt that intensification may involve a break-away from traditional cane culture, and many will view this break with considerable trepidation since it may mean the abandonment of certain long-established and hallowed practices, which have been the very foundation of the success of the industry to the present day.

"It is important therefore that there should be greater appreciation of the consequences of change. In particular, the various interacting factors affecting crop production need to be fully understood so that where these are deleterious, appropriate compensative measures may be taken or, where beneficial, they can be exploited to the full. Much of the research effort of the Experiment Station has been devoted to such problems during the past year. Valuable information has come to light as a result of this work and it is anticipated that this will be of considerable value to the farmer planning his programme of intensification."

Development Programme

Considerable developments, including the establishment of new out-stations, are proposed. A fourfold increase is planned in the number of seedlings raised by the plant breeding section, this being rendered possible by the construction of additional glass houses and provision of other facilities. Two proposed new substations, each of 60 acres, one at Pongola and one at Umhlatuzi, are to be developed as environment stations for testing new varieties. It is hoped that 3 more out-stations, each of 120 acres, will be acquired in other areas for similar purposes—one on the north coast of Natal, one of the south coast and a third in a high altitude area.

The main part of the plant physiology research programme has been in abeyance pending completion of the plant physiology laboratory. A number of projects, such as root studies and the preparation and standardization of equipment for microclimate studies in the growing crop, have been started in collaboration with other research sections.

Soils and Nutrition

Soil-water relationships have been the subjects of close study in order to provide the basic information needed to formulate advice on irrigating sugar cane on a wide variety of soil types. Studies have also been started on the ill-effects of soil compaction, e.g. the effects of infield transport.

Some interesting observations are made on the subject of soil nitrogen. Air-dry soils have the peculiar property, when rewetted, of converting through bacterial action non-available organic nitrogen into forms which are available to the plant and which are known collectively as mineral nitrogen. In Natal the short winter is normally dry. "There seems little doubt that this soil phenomenon is very largely responsible for the hitherto inexplicable lack of, or small response to, nitrogenous fertilizers applied to plant cane on the majority of the soils in the cane belt. It also indicates that early winter ploughing, followed by a very early spring replant, will permit the maximum exploitation of this beneficial soil characteristic."

In a discussion on leaf sampling technique for estimation of N, P and K, with reference to fertilizers, it is pointed out that these estimations may be profoundly affected by the moisture status of the soil and the rate of plant growth at the time of sampling. This of course raises problems when leaf samples are submitted by growers. It has been shown that sodium is present in the 3rd–6th leaf sheath and the growing point of the stalk only when soil moisture is adequate. When sodium is present in the growing point, maximum levels of N, P and K are to be found in the 3rd leaf lamina. This provides the needed indication that samples have been taken under optimum conditions and ensures increased accuracy in estimating crop fertilizer requirements.

Breeding and New Varieties

Investigations are being carried out on methods of improving breeding techniques at all stages including control of flowering, fertilization, seed setting, ripening and storage. The horticultural aspects of raising seedlings are also being investigated. As filtrability is now an industrial problem, starch content of the cane stalk has been introduced as an additional criterion in the selection of new varieties.

Attention is drawn to the manner in which the new variety N 50/211 has leapt into popularity during the last 2 years. This seems to be mainly due to its ability to grow vigorously during the first year. In spite of conflicting opinions regarding its sucrose content this variety seems well suited to the present situation of expanding production. Reference is made to various other Natal-bred varieties which show promise but which are not yet released.

Weed Control

The screening of herbicides was continued during the year and more critical work carried out with the more promising types. "Paraquat" seriously affected "watergrass" (*Cyperus* sp.) but only for about 4 weeks, so that at present spraying with it may be regarded solely as a time- and labour-saving operation.

A number of herbicides gave good control of a wide variety of weeds under irrigated conditions, but their behaviour was more erratic under the more unpredictable moisture conditions of dryland cultivation. A reliable general purpose herbicide for dryland areas in South Africa has still to be found.

Pests and Diseases

The measures taken to control the new insect pest *Numicia viridis* in the Pongola area, i.e. aerial application of "Malathion" dust, are mentioned. They are regarded as interim emergency measures designed to protect the immediate crop pending accumulation of essential information on the ecology and life history of the pest. A number of different types of parasites and predators have been discovered. Their efficiency in controlling the pest has still to be evaluated. Populations of *Numicia* in most of the affected areas seem to be on the decline. The reason for this is at present not known. *Numicia* studies have constituted the most important feature of the work of the entomology section. An account of the work and of the results of a detailed *Numicia* survey are given.

A new or unusual disease of sugar cane (a stem rot) in the higher altitude cane areas of Natal is referred to, the causal organism having been isolated but not yet identified. It seems the disease is likely to be serious only under conditions of high humidity. Even badly infected stools nearly all recovered when grown in tins at the Experiment Station which is at low altitude. The first noticeable symptoms are gradual stunting and death of individual stools.

Mosaic disease continued to be a serious factor in losses in yield. Much attention is being devoted to it, and in variety selection work to improving the testing technique for this particular disease. Work on the different strains of the disease present in Natal cane fields was continued. So far two strains and a substrain have been tentatively isolated. These are described.

F.N.H.

AGRICULTURAL ABSTRACTS

Redistribution of nitrate in soils and its effects on sugar beet nutrition. M. STOUT. *J. Amer. Soc. Sugar Beet Tech.*, 1964, **13**, 68–80.—An account is given of field studies involving deep *versus* shallow furrowing in connexion with nitrate distribution. The importance of correct timing and application of nitrogen with sugar beet, especially under dry conditions, is emphasized.

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Effectiveness of PEBC, DATC and "Endothal" for controlling weeds in sugar beets in western Nebraska. G. A. WICKS and F. N. ANDERSON. *J. Amer. Soc. Sugar Beet Tech.*, 1964, **13**, (1), 81–95.—Applied before planting and incorporated in soil to a depth of 2 to 3 inches, PEBC (propyl ethyl-*n*-butyl-thiocarbamate) was shown to be the outstanding herbicide. Control of annual grasses and pigweed was complete but it did not control kochia or black nightshade. DATC gave acceptable control of grass but not broadleaf weeds. "Endothal" did not give consistent weed control under prevailing conditions.

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Aerial application of ripeners increases yields. M. L. CRESP. *Sugar y Azúcar*, 1964, **59**, (10), 21–23. Results of experiments in Colombia showed that yields of plant cane may be considerably increased (9–10%) by removing chemical deficiencies by aerial application of P and K. Lower increases resulted with ratoon cane. MAP (monoammonium phosphate) and MKP (monopotassium phosphate) were mainly used. Four atomizers were attached to each aircraft, delivering 15–30 lb/acre.

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Yield performance of sugar cane varieties from field experiments conducted during the last three crop years. F. T. TABAYOYONG. *Sugar News*, 1964, **40**, 450–452.—Eight new varieties recommended for commercial planting in the Philippines, in addition to the 4 already grown, are here described. One, Phil. 54-60, was bred in the Philippines, at La Granja Experiment Station of the Philippines Sugar Institute.

Urea in crop production in Andhra Pradesh. A. E. SOOMAR. *Fertilizer News*, 1964, **9**, (12), 12–17.—Sugar cane is an important cash crop. Trials with urea on cane were conducted on Government farms and cultivator's fields. Results showed a slightly higher yield for urea as compared with ammonium sulphate in most cases.

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Plans to extend Lantana eradication scheme. ANON. *S. African Sugar J.*, 1964, **48**, 833.—The weed *Lantana camera*, called "tickberry" in Zululand, is native to tropical America but is now naturalized in other warm countries. It is present in parts of the Natal sugar cane belt. The Department of Agriculture eradication schemes are proving successful and are to be extended.

* * *

F 780—a new variety of Taiwan cane. ANON. *Sugarland* (Philippines), 1964, **1**, (8), 58.—A brief description of this variety, its capabilities and performance (in Taiwan) is given. Its virtues include high yield, early maturity, non-flowering, suitability for spring or autumn planting and strong ratooning ability.

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The sugar industry in western Uttar Pradesh. M. L. MODI. *Indian Sugar*, 1964, **14**, 411–414.—Reasons for the now depressed state of the sugar industry are discussed and some remedial measures suggested. Among the latter is the dropping of old and outdated varieties.

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Inadequate irrigation—the main problem of the north Indian sugar industry. M. KHAITAN. *Indian Sugar*, 1964, **14**, 417–419.—Apart from boosting the economy of the region in general and cane production in particular, adequate irrigation could prolong the crushing season to 170 days thereby reducing overheads at factories. The opinion is expressed that Uttar Pradesh could be the cheapest sugar producer in the world.

The sugar cane varietal position in Bihar. J. N. BAJPAI. *Indian Sugar*, 1964, **14**, 421–425.—Attention is drawn to the short life of new varieties under Bihar conditions and to the puzzling fact that the useful life of new varieties generally appears to be getting shorter and shorter. There is wide variation in the effective life span of different varieties, exemplified by a table.

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Puerto Rico faces its problems. M. A. MASCARÓ. *Sugar y Azúcar*, 1964, **59**, (11), 5.—The combination of factors that account for the decline of the sugar industry is explained. It is pointed out that other cane growing countries have also had to face almost insurmountable problems and have solved them.

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A guide to the soils of Puerto Rico. J. A. BONNET. *Sugar y Azúcar*, 1964, **59**, (11), 62–64.—The geology and soils of the island are briefly described with the assistance of maps. Soils are classified into 28 groups suitable for sugar cane.

* * *

Aircraft improves agricultural operations. A. RIOLLANO. *Sugar y Azúcar*, 1964, **59**, (11), 67–68.—The use of aircraft in Puerto Rico for applying fertilizers and insecticides to sugar cane is described. There are 4 private organizations offering aircraft for agricultural services.

* * *

What is compost? ANON. *Bol. Azuc. Mex.*, 1964, (182), 14–18.—This is a general discussion on compost and humus. Details are given on the production of compost in cane growing and the utilization of bagasse and other products from sugar cane production.

* * *

Studying the cause of tractor mishaps. ANON. *Australian Sugar J.*, 1964, **56**, 561.—At Queensland University tests are being carried out to try to find out why tractors sometimes roll over unexpectedly, even on fairly level ground. A tubular steel frame has been built round a farm tractor for protection while it is deliberately thrown out of balance.

* * *

A sugar cane pest. F. O. BRIEGER. *Bol. Informativo Copereste* (São Paulo), 1964, **3**, (26), 3 pp.—Details are given about *Elasmopalpus lignosellus* (rice borer) which attacks the bases of the shoots of newly planted cane in Brazil.

* * *

Progress report on chemical weed control on sugar cane in the Philippines. *Farmers' J.*, 1963, **5**, (1), 34–37; through *Weed Abs.*, 1964, **13**, 308.—Post emergence tests with 8 annual weeds gave over 99% control. A combined spray of "Monuron" at 2·2 kg/ha and "Dalapon" at 2·2 kg/ha gave the best results.

* * *

Phytopathological observations on nine sugar cane varieties introduced from Hawaii. M. V. REVILLA. *Agronomia* (Lima), 1963, **30**, (2), 13–23; through *Rev. Appl. Mycology*, 1965, **44**, 157.—Diseases observed on these varieties (introduced 1958–60) included: mosaic (a virus) on 5, leaf-splitting disease (*Sclerospora*) on 5, Pokkah Boeng (*Gibberella moniliformis*) on 3, chlorotic streak (virus) on 1. Only one variety, H 49-3533, was disease-free.

* * *

Leaf scald of sugar cane in Ceylon. S. N. DE S. SENEVIRATNE. *Trop. Agriculturalist* (Ceylon), 1962, 118, (3), 109–115.—The symptoms of leaf scald (*Xanthomonas albilineans*) in Ceylon are described. The names of imported varieties that have proved resistant in screening tests are given.

* * *

Resistance of sugar cane to 2,4-D, TCA and "Monuron". V. S. TRIPPI. *Rev. Agron. Noroeste Arg.*, 1963, **4**, (1), 85–87; through *Weed Abs.*, 1964, **13**, 308.—2,4-D isopropyl ester up to 12 l/ha caused no injury, nor TCA Na salt at 12 kg/ha in crops up to 50 cm high. It was concluded that the commonly recommended mixture of 2,4-D + TCA could be safely used in sugar cane. "Monuron" at 1–2 kg/ha caused no crop injury but 4 kg/ha did.

* * *

Tolerance of sugar cane varieties to herbicides. R. W. MILLHOLLON and R. J. MATHERNE. *Abstr.* 1964 *Mtg. Weed Soc. Amer.*; through *Weed Abs.*, 1964, **13**, 308. All varieties were uniformly tolerant of "Simazine" applied at up to 12 lb/acre after planting and before covering with soil. "Fenac" and "Dalapon" inhibited root and shoot development. There were varietal differences in response to post-emergence treatments.

* * *

Advances in the study of sugar cane diseases in Venezuela. G. MALAGUTI. *Ingenieria Agron.*, 1964, **13**, 18–20; through *Rev. Appl. Mycology*, 1965, **44**, 157. Observations are made on sugar cane diseases known to occur in Venezuela, some being only recently recorded, i.e. since 1962. Ratoon stunting disease affected some varieties severely, others lightly. Chlorotic streak, another virus disease, also varied in intensity with different varieties. Red stripe and top rot (*Xanthomonas rubrilineans*) was diagnosed by inoculation into the variety B4362 but produced only reddish stripes, never the severe symptoms sometimes seen elsewhere.

PULP DRYERS

By W. M. LANYON and F. W. SPRIGGS
(British Sugar Corporation Ltd.)

THE maintenance costs on the standard Buell/Büttner pulp dryers have for years been high throughout the British Sugar Corporation.

The inaccessibility of the internal shelving when it is due for repairs is a major factor in increasing the cost of the work and this article deals with this aspect.

In the pulp dryers in the British Sugar Corporation there are four main disadvantages with the present method of shelving support, viz:

1. The steps and outer shelves are supported by bolts passing through the drum shell. This means that all sheet lagging, etc. must be taken off to get at the bolt heads.

2. Only the two ends can be examined. The centre shelves and supports cannot be reached without dismantling all the outer shelves.

3. If one shelf in a section fails, a minimum of half a section must be taken out to replace it.

4. The nature of the shelf arrangement causes the pulp to congregate progressively in two areas 180° apart causing undue corrosion of the shell and reducing the drying efficiency.

The British Sugar Corporation have installed at one of their factories a new system of pulp dryer internals that overcomes all four of the disadvantages mentioned, which, it is hoped, will reduce the maintenance costs of this plant.

The idea is to divide the sections of shelves into separate units and have between them a two-foot gap. There is access via a manhole in the drum side to each of these gaps, so that the end supports of all the shelves can be examined thoroughly without dismantling anything.

The two-foot gaps have round their periphery scroll flights similar to those at the feed end of the dryer except, of course, they are shorter.

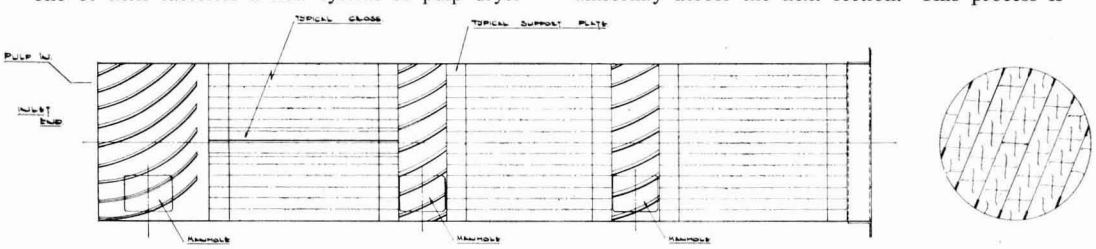
All flights and shelf supports are bolted to lugs welded to the inside of the drum, so that no bolts pass through the shell and the lagging can, therefore, be left in place permanently. This makes it possible to use cheaper lagging wired onto the drum and covered by sheet steel or any other finish desired.

The present system of shelf support, where the shelves slot into the steps, is replaced by permanent heavy steel flat bars that span the drum on the chord of the circle parallel to each other. Lugs are welded to these flats and the shelves in turn bolted to the lugs (see Fig.). Slotted holes are used in all cases to allow for expansion.

At the periphery of the drum where lifter shelves used to be bolted, there are now shelves of exactly the same shape but supported only at each end, angle iron being used to give the shelf adequate stiffness.

It can be seen from this that to remove any one shelf in the end sections it is only necessary to unbolt it at each end and slide it out. All the other shelves remain in position fully supported. In the case of a shelf in a centre section needing removal, it is only necessary to remove the corresponding shelf in the end section and then pass the centre section shelf through the end section and out.

The distribution of pulp with the new arrangement is good throughout the length of the drum. When pulp passes out of the first section it falls into the two-foot gap where scroll flights redistribute it uniformly across the next section. This process is repeated at each gap with the result that pulp is uniformly distributed across the drum even at the end of the last section.



A further refinement to help give correct distribution consists of guide vanes welded to the flat support bars. This ensures that when pulp is lifted up and rests on the flat section, it slides down the flat and is guided into the appropriate shelf.

The trial installation has run one campaign and was in good condition when inspected. The capacity of the dryer was not impaired and its efficiency as far as was measurable was at least as good. No difficulty with automatic control of the dryer was experienced. It is felt that it is worth while proceeding with this development and this modification is being incorporated when major repairs are made to a pulp dryer.

THE NEW FINAL MOLASSES EXHAUSTION SCHEMES at Monymusk (Jamaica) and Brechin Castle (Trinidad)

By A. M. JAMES and R. E. LAWRENCE

(Tate & Lyle Technical Services Ltd.)

Paper presented to the 12th Congress I.S.S.C.T., 1965.

PART II

Operation

The best possible results from this plant derive from steady and continuous working. Only small and gradual adjustments should be made. Care is required that strikes come forward from the pans at reasonably even intervals. The centrifugals must purge the massecuite at a steady rate and not in intermittent batches.

No trouble has been experienced with the flow through the original Blanchard crystallizers. During operation the total head loss through the series of six vessels was found to be only six inches. However, at times, when working with very cool massecuites, difficulty was experienced in getting an adequate rate of flow through the Werkspoor. It has been found helpful to raise the head of massecuite at the entry to the Werkspoor and to cover the top of the vessel to prevent overflowing. It is intended also to try enlarging the angled pusher blades, on each element, which convey the massecuite along the vessel. Lubrication with hot final molasses has also been practised mainly by applying a trickle onto the top of each element. No lubrication was found necessary at the Blanchard crystallizers.

Water as a massecuite lubricant should be considered an emergency measure only. All lubrication is carried out with hot undiluted, or slightly diluted and well mixed, final molasses. Even so, lubrication is kept to the minimum to avoid inhibiting the rate of crystallization with the recycled impurities and to avoid overloading the centrifugal station. However, it will probably be necessary to lubricate in order to get efficient purging from the continuous machines which are currently being installed at the *C*-massecuite station, as it has been found that these do not work well on very viscous massecuites.

Some teething troubles were experienced in the early stages, particularly with the control system, but these have been overcome. The overall system now requires very little attention when in operation. The operators at each end of the plant make such small adjustments as are necessary from time to time.

The only cleaning required is an occasional steaming out of the metering pump suction and discharge lines which gradually build up with hard sugar. The Green-Smith heater has steaming out facilities which are used if there is evidence that the elements are becoming blocked with hard sugar, probably in the form of lumps which have broken away from the sides of the crystallizers.

No ill effects have been experienced from mixing strikes. On the rare occasion when a smeared massecuite was dropped from the pan, it appeared to retain its identity through the plant and only affected the centrifugals for the duration of about one strike. Some mixing with the strikes on either side must occur, and it is hoped that with the coming of continuous centriguals there will be even less effect on the factory. Continuous machines have shown themselves to be capable of dealing with such strikes with much less hindrance in time and quality than can batch machines.

Careful examination of the temperature gradient through the system suggested that some of the Blanchard crystallizers were not cooling the massecuite as much as they should. Fouled tubes were suspected and these will have been cleaned internally during the 1964 maintenance season.

Results

The attached Table I is based on the averages of a number of tests following the massecuite through the system. They were carried out at Brechin Castle. The samples were taken from the outlet of the crystallizers and the temperature taken at the spot. The sample was then taken to the laboratory and centrifuged immediately. Analysis followed directly.

Table I

Crystallizer Number	*Temp (°C)*	*Apparent purity*	*Purity drop*	*Viscosity (cp)*	*C-Sugar Pol*
1	61·1	34·83	—	4,390	93·67
2	56·4	32·51	2·32	9,000	93·90
3	53·1	32·06	0·45	11,430	92·90
4	51·1	30·85	1·21	12,330	93·05
5	48·7	29·98	0·87	14,360	92·75
Werkspoor	41·6	28·88	1·10	16,850	91·45
Heater	50·4	28·64	0·24	12,720	93·56

The lowering of the molasses purity across the heater should be noted. This could be explained by the removal from the crystal, after heating, of the highly exhausted sleeve of mother syrup. This "impurity sleeve", as it is sometimes known, remains around the crystal when cool massecuite is spun. After heating, when the viscosity is appreciably reduced, the centrifugal is able to remove more of the adherent molasses film from the crystal. The result is a lower average molasses purity and a higher sugar purity. A water temperature 4°C above the desired massecuite temperature was used.

Table II shows a comparison of the average final molasses apparent purities for 1963 and 1964 at Brechin Castle, Ste. Madeleine, Monymusk and Frome factories. Ste. Madeleine is a factory in Trinidad comparable with Brechin Castle. It may be argued that Brechin Castle shows a gain of 3·88 degrees, due

to the new exhaustion scheme, and this despite an increase in the average hourly grinding rate from 300·4 tons to 326·1 tons. Likewise, Frome is a factory in Jamaica comparable with Monymusk, but at which final molasses apparent purities are traditionally very low. Monymusk achieved the lower molasses purity at the same time as the average hourly grinding rate was increased from 185·1 tons to 209·7 tons.

Table II

	Average Final Molasses Apparent Purities		
Factory	1963	1964	*Difference*
TRINIDAD:			
Brechin Castle	32·01	29·38	2·63 *decrease*
Ste. Madeleine	31·73	32·98	1·25 *increase*
JAMAICA:			
Monymusk	36·40	32·60	3·80 *decrease*
Frome	33·26	32·46	0·80 *decrease*

Tables III and IV show comparisons of the same factories, but with reference to pol recovered in sugar percent pol in juice and to pol lost in final molasses percent pol in juice. Both tables speak for themselves.

Table III

	Pol recovered in Sugar		*% Pol in Juice*
Factory	1963	1964	*Difference*
TRINIDAD:			
Brechin Castle	89·83	90·97	1·14 *increase*
Ste. Madeleine	89·07	89·46	0·39 *increase*
JAMAICA:			
Monymusk	87·64	89·17	1·53 *increase*
Frome	89·28	89·35	0·07 *increase*

Table IV

	Pol. lost in Final Molasses		*% Pol. in Juice*
Factory	1963	1964	*Difference*
TRINIDAD:			
Brechin Castle	9·86	8·55	1·31 *decrease*
Ste. Madeleine	9·40	9·28	0·12 *decrease*
JAMAICA:			
Monymusk	10·25	8·78	1·47 *decrease*
Frome	9·78	9·57	0·21 *decrease*

It is difficult to express the efficiency of the schemes against the theoretical maximum obtainable because of the arbitrary nature of the formulae available. However, actual results at Monymusk have been plotted against the "ideal true purities", calculated using the formula of DOUWES DEKKER*, for 1963 and 1964 (Fig. 7). The molasses exhaustion scheme went into operation at the start of weekly run number five. Again, these graphs speak for themselves.

CONCLUSIONS

We are well satisfied that each part of the schemes has justified its inclusion. Similar plants are currently being installed at Frome in Jamaica, and at Ste. Madeleine in Trinidad, which should be in operation for the 1965 crop. On the basis of raw sugar at £30 per ton, it has been calculated that the plants have very nearly paid for their complete costs in the first year of operation. We are confident that they will do even better during the 1965 crop.

SUMMARY

Monymusk and Brechin Castle factories have, over the years, increased their grinding rates but without a proportional increase in boiling house capacity. In the 1963 off-season their final molasses exhaustion plants were reorganized and expanded.

The requirement of each scheme was to cool the *C*-massecuite to about 42°C in the optimum acceptable time, and then reheat it to about 52°C without redissolving sucrose. Factory space being limited, all new plant had to be compact, and maximum use of existing plant was to be made.

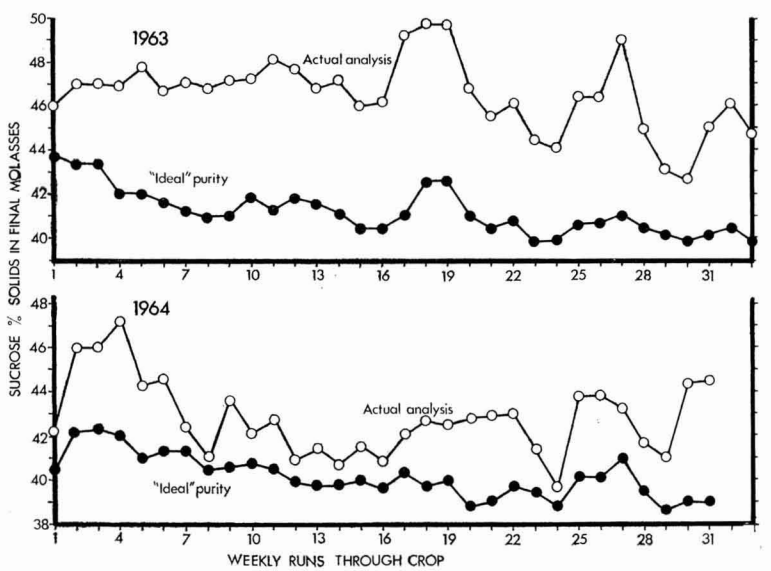


Fig. 7

The existing Blanchard-crystallizers were connected together to operate continuously in series. These were fed, via a metering pump, from a strike receiver under the vacuum pans. A Werkspoor Rapid crystallizer was added to the flow line after the Blanchards. A Green-Smith massecuite heater completed the scheme.

Controls on the panel were semi-automatic so that the attention required was mainly supervisory. Successful operation depended on smooth continuous operation. The main operational difficulties have been

* "Ideal" sucrose % = $36 - 0{\cdot}08r + 0{\cdot}26a$, where r = invert % non-sucrose and a = sulphate ash % non-sucrose.

associated with the flow of very viscous massecuite through the Werkspoor.

Results have been very satisfactory. A table shows steady exhaustion of the molasses through the massecuite path. Particular note is made of the lowering of molasses quality and raising of sugar quality across the heater. A reduction of final molasses apparent purity has been achieved at Monymusk and at Brechin Castle of the order of three degrees. At both factories the extra yield of sucrose during the first year of operation has shown the schemes to be sound economic propositions.

INFLUENCE OF THE DECOLORIZATION OF SUGAR JUICES AND PRODUCTS ON THE CRYSTALLIZATION RATE IN IMPURE SOLUTIONS

By Prof. Dr. STANISLAW ZAGRODZKI and Dr. HELENA ZAORSKA
(Dept. of Sugar Industry and Food Technology, Lodz Technical University)

PART I

THE problem of sucrose crystallization rate in impure solutions is not new and has already been investigated by various workers. These studies[1–8] have generally been concerned with the addition of electrolytes to sucrose solutions. Considerably fewer experiments[9–15] have been reported on the sucrose crystallization rate in factory sugar products of various purities. According to SILIN[13] the crystallization rate in lower purity solutions is some 55–64 times slower than in pure sucrose solutions. Few studies [3,16–17] have been made of the sucrose crystallization rate at temperatures above 70°C, although it is this region that is the most interesting.

The following formula can be used to calculate the crystallization rate of sucrose[18]:

$$\frac{dS}{dt} = -DF\frac{C - C_s}{l}\eta \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

where S is the amount of sucrose crystallized in time t, D = diffusion coefficient, F = total crystal surface area, C = sucrose concentration in supersaturated solution, C_s = sucrose concentration in saturated solution at a given temperature and purity, and η = coefficient expressing the effect of non-sugars on the crystallization rate. In aqueous solutions of pure sucrose $\eta = 1$.

This formula for crystallization rate is valid only for certain temperature ranges. This is the case where crystallization is regarded as a diffusion process, i.e. where the diffusion of sucrose through the thin layer surrounding each crystal is the slowest process. Hence the formula determines the crystallization rate. In the formula, l = depth of the diffusion layer which is also dependent, *inter alia*, on the movement of the crystals relative to the mother liquor.

Not all workers consider the formula to be correct and for this reason the matter should be regarded as debatable.

Irrespective of the form in which we express the sucrose crystallization rate, it is always of interest to compare the crystallization rates in solutions relative to those of pure sucrose solutions. Naturally, the crystallization process must be carried out under identical conditions, i.e. identical temperature, circulation, supersaturation and crystal surface area.

In all experiments of this type it should be possible to determine the relationship between the value of η and (1) the quantity of non-sugars in the solution and/or (2) the purity of the mother liquor. These relationships would be constant if the kind and proportion of non-sugars were the same in all factory solutions. However, in fact, the amounts of the various non-sugars are not the same for different beet and different periods of a campaign. Because of this, numerous studies have been made of the effect of given non-sugars, e.g. invert and a number of

[1] KUKHARENKO: *3rd Congr. Intern. Tech. Chim. Ind. Agric.* (Paris), 1934, Q.IV.
[2] VANHOOK: *Ind. Eng. Chem.*, 1946, **38**, 50.
[3] DUBOURG & SAUNIER: *Bull. Soc. Chim. France*, 1939, **6**, 1196.
[4] MIRČEV & SANDERA: *Listy Cukr.*, 1955, **71**, 37–40; *I.S.J.*, 1955, **57**, 443.
[5] MANTOVANI & FAGIOLI: *Gaz. Cukr.*, 1964, **72**, 278.
[6] CAVALLARO & MANTOVANI: *Ind. Sacc. Ital.*, 1953, **46**, 188–193; *I.S.J.*, 1954, **56**, 84.
[7] SANDERA: *Zeitsch. Tschech. Zuckerind.*, 1927, **8**, 401.
[8] DĚDEK: *Listy Cukr.*, 1932, **51**, 125.
[9] NAKHAMANOVICH & ZELIKMAN: *Nauch. Zapiski Sakhar. Prom.*, 1928, **6**, 109.
[10] GRUT: *Zucker*, 1953, **6**, 411–416; *I.S.J.*, 1954, **56**, 19.
[11] SMOLEŃSKI & ZELAZNY: *Gaz. Cukr.*, 1934, **74**, 303; *I.S.J.*, 1935, **37**, 318.
[12] VANHOOK: *Ind. Eng. Chem.*, 1948, **40**, 85–89; *I.S.J.*, 1949, **51**, 63.
[13] SILIN: *I.S.J.*, 1935, **37**, 403.
[14] BRIEGHEL-MÜLLER: *Zucker*, 1962, **15**, 596–600; *I.S.J.*, 1963, **65**, 152.
[15] KAGANOV & ZHIGALOV: *Sakhar. Prom.*, 1964, **38**, 409–412; 1965, **39**, 16–19; *I.S.J.*, 1965, **67**, 89, 187.
[16] DE VRIES: *Chem. Weekblad*, 1935, **32**, 36; 1947, **6**–7, 82, 99; references in "Principles of Sugar Technology" Vo. II. Ed. P. HONIG. (Elsevier, Amsterdam.) pp. 158, 166.
[17] MÖLLER & SCHMIDT: *Zeitsch. Zuckerind.*, 1963, **13**, 501–504; *I.S.J.*, 1964, **66**, 127.
[18] ZAGRODZKI: *Wiad. Chem.*, 1959, **13**, 185.

cations or anions, on the crystallization rate in impure solutions. For technological reasons it is necessary to carry out complex tests, but complex studies of sucrose crystallization rate in impure solutions are beset with difficulties.

Our tests were made on juices and factory products which were obtained from a sugar factory in November. Naturally, the results of such tests will not represent absolute values, but they could give some insight into the problems under discussion, which from the viewpoint of the course of the technological process are important in a large number of sugar factories.

In this work the problem has been put forward as follows: to what extent do non-sugars affect the sucrose crystallization rate in impure solutions and what part is played by colouring matter found in sugar products? For the sake of accuracy it must be remembered that by "colouring matter" we mean a mixture of many compounds and that during decolorization of sugar solutions, e.g. using activated carbon, not only colouring matter but also other large-particle substances, particularly colloidal compounds, will be retained on the surface of the adsorbent. Therefore, it would be more correct to say that we have studied the effect of the mixture of colouring matter and other compounds adsorbed by the active carbon on the sucrose crystallization rate. We also studied the influence of those non-sugars not adsorbed by the active carbon but passing into the decolorized solutions together with sucrose.

Experimental

The following constant conditions were maintained during the tests: temperature of 80°C, supersaturation of 1·15, mean size of initial grain (weight of single crystal) 2·6 mg, circulation rate of the sugar crystals relative to the mother liquor 90 cm/min.

The solutions were brought to the required concentration, analysed and crystallization carried out under identical conditions, in adiabatic Dewar flasks placed in a thermostat. The temperature of the massecuite was measured throughout the complete process. To ensure uniform circulation, the sugar crystals were placed in cylindrical wire cages, which moved at a speed of 90 cm/min relative to the mother liquor as a result of rotation of the flask about one axis (Fig. 1).

The results of individual tests diverged by 2–7% with a mean error of <5%, e.g. the sucrose crystallization rate in pure solution was 512, 518 and 523 mg/min. These results were obtained from three "double crystallizations", i.e. 6 tests.

The most difficult task lay in the preparation of suitable solutions for crystallization. At first we had to make up "conventional" syrups from juices or factory products and analogous solutions that had been previously decolorized using active carbon columns. To obtain higher purity sucrose solutions containing colouring matter, we prepared model sucrose solutions and added colouring matter ex-

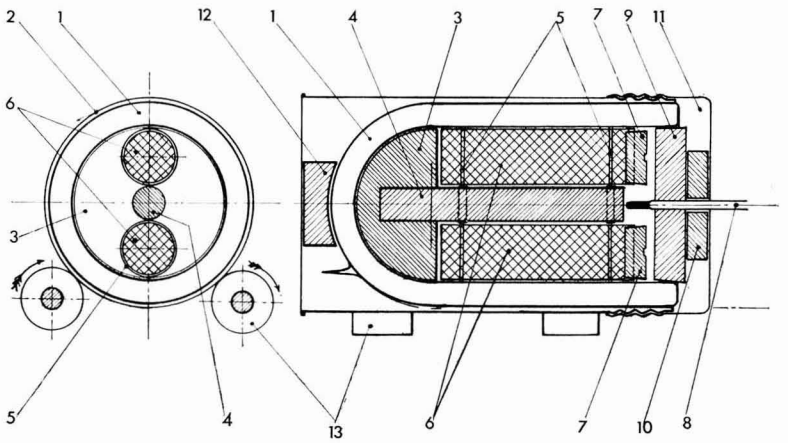


Fig. 1. Crystallizer.
1. Dewar vessel; 2. Housing; 3. Rubber packing; 4. Steel bolt; 5. Cage holder; 6. Wire cages; 7, 9. Rubber stoppers; 8. Thermometer; 10. Rubber compression ring; 11. Lid; 12. Rubber washer; 13. Drive rolls.

Table I

The rate of sucrose crystallization from sugar solutions of various purity for decolorized and industrial solutions

	The rate of sucrose crystallization in %			
	solutions		*solutions*	
	pure	*decolorized*	*artificially colorized*	*industrial*
solution of refined sugar purity of 100–98·5	100·00	—	53·60* 45·20†	
mother liquor of 1st massecuite purity 94–93	—	57·25	—	29·45
mother liquor of 2nd massecuite purity of 82–81	—	15·25	—	10·10
mother liquor of 3rd massecuite purity of 72–71	—	5·18	—	4·04

* The amounts of colouring matter added to solution correspond to the quantity of natural colouring substances in 1st massecuite.

† The amounts of colouring matter added to solution correspond to the quantity of natural colouring substances in 2nd massecuite.

tracted from active carbon by the aqueous azeotrope of pyridine[19]. The quantity of colouring matter added to the sucrose solutions depended on the amount of colouring matter in the thick juice or in the 2nd (middle product) massecuite. The solutions prepared with the colouring matter had purities in the range 98·5–99·7 depending on the quantity of colouring matter added. Thus the whole range of crystallization carried out in vacuum pans on a factory scale was covered. Four distinct purity ranges of mother liquor were examined:

sucrose solution of 100–98·5 purity with colouring matter added;
1st massecuite of 94–93 purity;
2nd massecuite of 82–81 purity; and
3rd massecuite of 72–71 purity.

As the tests are of a comparative nature, which is important for technological investigations, the crystallization rates cannot be expressed in terms of absolute values, although they could be obtained by calculating the thickness of the small diffusion layer, involving further tests.

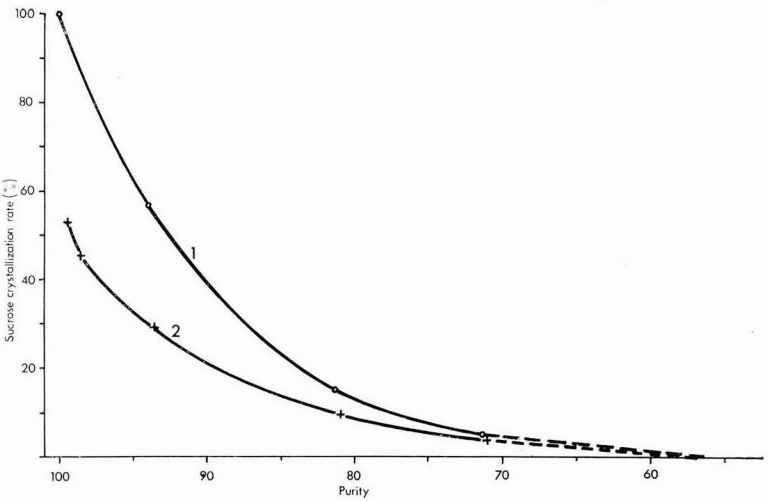


Fig. 2. Variation in sucrose crystallization rate with purity of the mother liquor. Crystallization rate is expressed as a percentage of the crystallization rate of pure sucrose = 100. (1) Pure and decolorized solutions. (2) Artificially coloured and "standard" solutions.

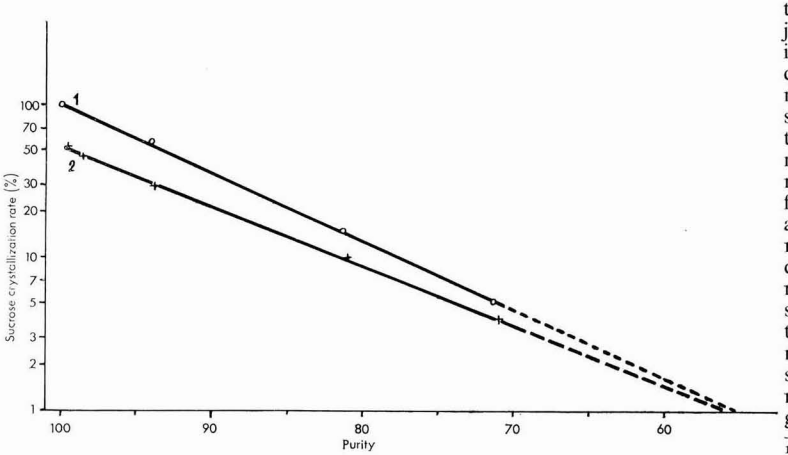


Fig. 3. Variation in sucrose crystallization rate with purity of the mother liquor. Crystallization rate is expressed as a percentage of the crystallization rate of pure sucrose = 100. (1) Pure and decolorized solutions. (2) Artificially coloured and "standard" solutions.

Results

The summarized results, which are the mean values from a large number of experiments, were expressed relative to the crystallization rates of sugar in pure sucrose solutions, taken as 100%. In this summary, the lowest values for the 3rd massecuite mother liquor averaged 4·04%. The results are given in Table I in the form of percentages.

As can be seen, the crystallization rate of sucrose in decolorized solutions is significantly higher than the sucrose crystallization rate in "standard" mother liquors. Coloured refined sugar solutions crystallize at a slower rate, despite their high purity of > 98·5, than decolorized thick juice of 94 purity. The introduction of the same quantity of colouring matter to pure sucrose solution as is found in thick juice considerably reduced the crystallization rate of pure sucrose. A further increase in the amount of colouring matter, e.g. up to the quantity found in 2nd massecuite, caused a slight additional reduction in the crystallization rate. In lower purity solutions the colouring matter content did not give rise to the great

[19] ZAORSKA: *Proc. 12th Gen. Assembly C.I.T.S.* (Paris), 1963, p.235–249; *I.S.J.*, 1964, **66**, 260–262, 285–286.

differences in sucrose crystallization rate as in the case of thick juice.

Changes in the sucrose crystallization rate with the purity of the mother liquor are expressed in the form of two curves in Fig. 2. To obtain a better comparison, this relationship is also given in the form of a semi-log graph (Fig. 3). The individual points, both for decolorized and for "standard" solutions, lie along the straight line. The distance between the two straight lines decreases as the purity of the solution falls. It can be assumed that the two lines would intersect as the crystallization rate tended to 0, i.e. at a solution purity of <60. The distance between the straight lines represents the ratio of the crystallization rate in decolorized solutions to the rate in coloured solutions.

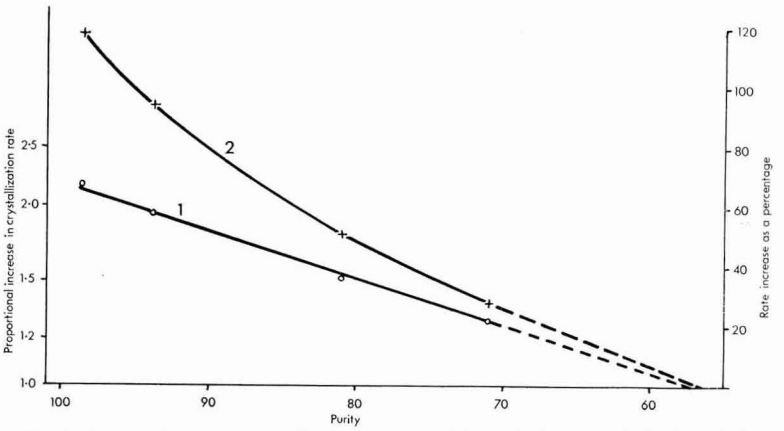


Fig. 4. Increase in sucrose crystallization rate caused by preliminary decolorization of the solution as a function of solution purity. (1) Proportional increase in crystallization rate. (2) Rate increase as a percentage.

In Fig. 4 is shown the increase in the crystallization rate caused by previous decolorization of solutions of varying purities. Curve 1, on a logarithmic scale, shows the ratio of the crystallization rate in decolorized solutions to that in non-decolorized solutions. The points lie almost in a straight line. Extension of this straight line would show that at purities below 60, decolorization of the solutions would cause a slight increase in the crystallization rate as this value tended to 0. The same values are also expressed in the form of a percentage increase in the crystallization rate (curve 2). The increase in crystallization rate of pure sugar solutions in relation to coloured model solutions obtained by adding colouring matter to refined sugar is 118%. A certain reduction in this ratio was observed in the 1st massecuite; on the other hand, the values found in the after-product massecuite showed a rise in the crystallization rate of something less than 28%.

(To be continued)

A NEW METHOD OF WORKING OF PLATE AND FRAME TYPE FILTER PRESSES

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THE usual method of operating the filter presses in a sugar factory is as follows:

(i) muddy juice from the settlers or clarifiers is discharged into an open tank,

(ii) muddy juice in the open tank is often prepared for good filtration by adding milk-of-lime and/or heating by introducing steam directly through perforated coils, and

(iii) the muddy juice is then filtered through the presses under pressure varying between 25 and 70 p.s.i.g. with the help of a duplex or centrifugal pump.

Observations made with this usual type of working are as follows:

(i) the fall in temperature of the muddy juice between clarifier and the filter is of the order of 20°F when muddy juice is not heated in the mud tank,

(ii) heating by direct contact of steam results in caramelization of sugar to some extent,

(iii) addition of milk-of-lime for better filtration disturbs the chemical and pH control of the process, and local over-liming (the mud tanks are not generally fitted with stirrers) at the temperature of the juice (usually above 200°F) results in undesirable destruction of the reducing sugars to some extent and produces dark coloured filtrate,

(iv) filter presses leak as a rule under high filtration pressure, involving not only the loss of sugar but also making the filter station dirty and unhygienic,

(v) recirculation of mud is considerable owing to leakage of the presses,

(vi) many plates and frames break during a season, and

(vii) consumption of filter cloth is high as it tears easily under high filtration pressure.

The author introduced a new system of working the filter presses at the Dhampur Sugar Mills so as to eliminate most of the above defects. The system was adopted during the season 1963–64 and has also been used during the next season 1964-65.

The mud tank and the mud pump were put out of use. The muddy juice was fed to the filter presses direct, the filtration pressure being the head available between the level of juice in the clarifier and level of filter presses, about 18 feet. The arrangement is shown in Fig. 1. The two outlets for muddy juice from the "Rapi-Dorr" were connected to a common pipe which fed the filters. A partition valve D was provided in the common muddy juice pipe line of the filter presses in such a way that it divided the presses into two batches of six presses each. The outflow of mud from the two mud compartments of the "Rapi-Dorr" was controlled by the valves A and B. By adopting the above system, it was expected that filtration would be better since (i) filtration would be taking place under a constant pressure; (ii) the resistance of the mud cake would be lower owing to its looseness as a result of the low filtration pressure (about 8 p.s.i.g. only) and (iii) viscosity would be reduced owing to the higher temperature of filtration. The observations made and the results obtained during the seasons 1963–64 and 1965–65 were as follows:—

(i) the pressure of filtration was constant at 8 p.s.i.g. in the Rapi-Dorr section and 9 p.s.i.g. on the BMA clarifier side,

(ii) the muddy juice temperature at the inlet to the filters was between 205 and 210°F, barely 2 to 3°F below the temperature of the juice in clarifiers,

(iii) the filtration rate was satisfactory,

(iv) the pH of the muddy juice was generally between 6 and 7, but there was no need to add milk-of-lime as the rate of filtration was quite satisfactory,

(v) the cake formed was porous and loose owing to the low pressure and did not compact so that its resistance was considerably reduced,

(vi) washing of filter cake was easier and comparatively economical,

(vii) leakages of the presses were rare,

(viii) the filter station remained clean and dry,

(ix) the breakage of plates and frames during the two seasons under review was nil, and

(x) consumption of filter cloth was appreciably reduced.

The following figures give the rate of filtration obtained. The filtration cycle was as follows:

Muddy juice filtration (in a batch of 3 presses for each clarifier)	= 90 minutes
First steaming	= 10 ,,
Water washing	= 25 ,,
Second washing	= 15 ,,
Opening and resetting	= 40 ,,
Total time	= 180 ,,
Press cake (of average 62% moisture) obtained per batch of 3 presses (average)	= 3960 lb
Volume of muddy juice filtered (estimated)	= 3100 gal
Average filtering area (per 3 presses)	= 2121 sq.ft.

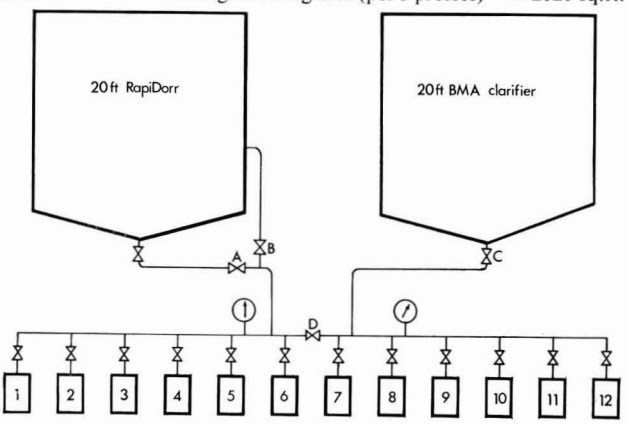

Fig. 1

Hence average rate of filtration = 0·974 gal/sq.ft./hr and filter cake formed is = 1·24 lb/sq.ft./hr.

The filter cake formation at the rate of 1·24 lb per square foot filtering area per hour is good, the normal rate of cake formation being about 1 lb per sq.ft. per hour working with the usual system.

That the filter cake washed easily and economically will be seen from the fact that the total time taken in steaming and water washing was 50 minutes, whereas this took about 65 minutes with the usual system of filtration. The comparative figures of the pol % cake for the seasons under review and previous two seasons (presses working under usual system) are:

		Pol % cake
New System	(i) Season 1963–64	3·58
	(ii) Season 1964–65	3·49
Usual System	(i) Season 1961–62	3·65
	(ii) Season 1962–63	3·74

The above data clearly show improvement in the washing quality of the filter cake.

Comparative figures of the consumption of filter cloth are:

			Filter cloth consumption (sq.m./metric ton cane)
New System	(i)	1963–64	0·0158
	(ii)	1964–65	0·0165
Usual System	(i)	1961–62	0·0227
	(ii)	1962–63	0·0242

It will be seen from the above that filter cloth consumption was substantially reduced.

Conclusion

The new system of working of filter presses at a constant low pressure and higher temperature was adopted and worked during the past two seasons. The observations and results show a definite and well marked improvement in the overall efficiency of the filter press station.

Acknowledgments

The author is grateful to Mr. V. K. GOEL, Director of The Dhampur Sugar Mills Ltd., for his interest and encouragement in the implementation of the new system of filtration.

BOLIVIAN SUGAR INDUSTRY REORGANIZATION

By Dr. H. KAMPF, Dr.Tech.Sc., F.R.I.C.
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ALTHOUGH sugar cane has been grown successfully in some neighbouring countries for some time, notably in Brazil and Argentina since the sixteenth century, Paraguay since the beginning of this century and in Peru on a large scale, it was not until 1944 that a cane sugar industry was started in Bolivia.

The Bolivian sugar industry consists of three mills: San Aurelio, Guabira and La Belgica. These mills, all of which produce plantation white sugar, are situated in the Santa Cruz department, which is also the centre for sugar cane production. A fourth mill, La Esperanza, which was erected in 1944, had to be closed down for economic reasons at the end of the last crushing season.

The daily cane crushing capacities of the three working mills are about 5000 metric tons. A new sugar factory having an initial crushing capacity of 1000 tons/day is being erected in a new cane area at Bermejo in the most southern part of Bolivia close to the Argentine border. The trial run of this mill is scheduled to take place in 1967 and in accordance with a revised programme full production of 10,000 tons of white sugar will not be permitted before 1968.

Sugar production in Bolivia jumped to 93,483 metric tons during 1964, an increase of 24,811 tons over 1963. Despite the population growth and the improvement of the standard of living, the average total consumption of sugar in 1964 was only slightly higher than in the previous year and amounted to no more than 73,500 metric tons, thus leaving the country with a sudden surplus of about 20,000 tons of white sugar.

Until quite recently there were no Government regulations concerning either cane or sugar production in Bolivia. In December 1964 the Minister of National Economy instructed the writer to head a small commission comprising an expert of the British Tropical Agricultural Mission and the Secretary of the Comisión Nacional de Estudio de la Caña y del Azúcar (CNECA) (National Commission for the Study of Cane and Sugar)in La Paz, to investigate the sugar industry's short- and long-term problems and make recommendations for the guidance, control, restriction and coordination of cane and sugar production. The commission's report was submitted to the Government on the 2nd February 1965. Based on the findings and recommendations of this report the Government of Bolivia issued a supreme decree, No. 07070 dated the 23rd February 1965, providing for the organization and the control of the sugar industry. The decree was signed by General RENE BARRIENTOS ORTUNO, President of the Military Junta of Government.

The preliminary of the decree very frankly admits that the national sugar industry, in spite of its notable development, is in a chaotic state at the moment, owing to the fact that essential rules for the planning and regulation of production have not been issued. As complete self-sufficiency of sugar has been obtained, Bolivia's domestic consumption should be increased and foundations laid for export to the free world market.

The next paragraph of the decree underlines the necessity of improving the living conditions of the workers in the sugar mills, to safeguard the economy of the cañeros (cane growers), small and large, and to ensure the supply of sugar to the consumer at the lowest possible price.

Positive orders and regulations are given by the Ministerial Cabinet in ten articles of the supreme decree; a condensed version of the contents is given below:

Article 1.—At the beginning of each calendar year the Ministry of National Economy, with the advice of the National Commission for the Study of Cane and Sugar (CNECA) shall fix quotas of sugar production for domestic consumption during the year.

Article 2.—authorizes the sugar mills to determine, by common agreement with the cane suppliers, the dates for the start and end of the crushing seasons, taking into account the condition and progress of the overhaul of the sugar machinery and the maturity of the sugar cane crop.

Article 3.—deals in detail with sugar production for domestic consumption and export. (*a*) The production of sugar for the internal market of Bolivia was authorized after long discussions at a round table conference under the Chairmanship of Col. JAIME BERDECIO, Minister of National Economy. The conference was attended by sugar industrialists, cane growers associations and representatives of the sugar workers. The following quotas for each mill were fixed for 1965, representing about 89% of the 1964 production:

	Quotas of white sugar	
	quintals	*metric tons*
Guabira	632,602	29,099·7
La Belgica	702,601	32,319·6
San Aurelio	472,601	21,739·6
Total	1,807,804	83,158·9

(*b*) of the production quotas assigned to the mills under (*a*) and of the previous year's surplus, unlimited quantities of sugar may be exported provided proper documents such as railroad bills of lading, export licences, etc. are submitted to the Ministry of National Economy. The exporting mill will receive in turn an authorization for an additional quota to replace the exported sugar. Export permits will be issued free of charge by the Ministry of Finance.

Article 4.—The price for 1965 of cane and sugar for domestic consumption will be determined, as in previous years, according to an already established formula. The prices of cane and other items such as transportation, etc. for the sugar produced for export, which must compete in the free world market, shall be completely free without fixation of quotas and other limitations.

Article 5.—directs the mills and affiliated companies to reduce slowly their own cane plantations, so that in three years their cane supplies to the mill shall not exceed 10% of the cane crushed to cover the domestic consumption quota. There will be no production limitations on cane for sugar made for export.

Article 6.—compels the mills and cane growers to redistribute the quotas for cane delivery in favour of the small land holders.

Article 7.—states clearly that the administration of the mills is free and the exclusive responsibility of each company. However, in order to guarantee the normal and safe working of the mills during the crushing season, it has been decided that:

(*a*) 15 days before the start of the crushing season, the mills must give due notice to the CNECA to enable this organization and their Technical Consultant to inspect the installations, verifying especially

(1) whether the buildings and machinery are in proper condition to prevent accidents endangering the safety and lives of technical personnel, workers and others.

(2) whether the weighbridges for cane are in proper working order and recording correct weights and whether the laboratory equipment and the analysts will guarantee the exact determination of the sugar content of the cane.

(*b*) The CNECA will employ Inspectors of each mill to check and control

(1) the production of sugar for domestic consumption (quota) and for export, and

(2) the production of potable and denatured alcohol.

(*c*) The mills shall ensure the supply of only fresh cane for crushing; that the time between cutting the cane in the fields and the arrival at the yard of the factory may not exceed 24 hours, and that the time lag between yard storage and actual milling must be less than 12 hours.

(*d*) To permit better control of production, the mills should install, within a maximum period of one year from the date of the decree, proper scales for the weighment of cane, mixed juice and final molasses.

(*e*) Within three years at latest from the date of the decree, the mills are obliged to build houses, schools, hospitals, recreation grounds, etc., as well as install electric light and drinking water for all personnel and their families.

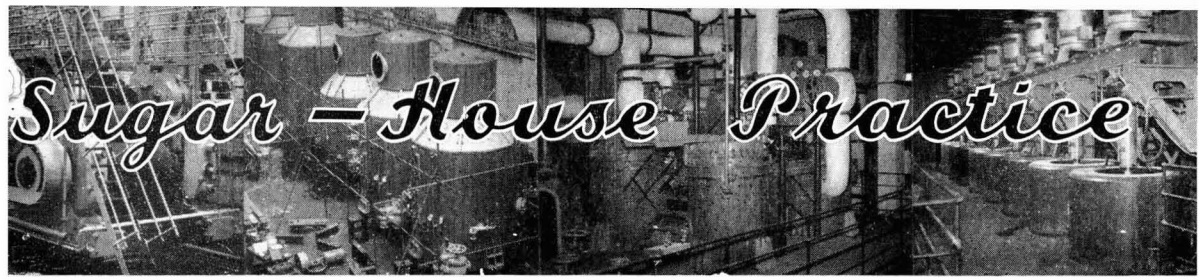
(*f*) The Technical Assessor of the CNECA will carry out periodic inspections of the factories during the season and the off-season to enable him to prepare reports and make recommendations on the efficient working of the mills, their agricultural achievements, sugar recoveries and losses.

Article 8.—Warrant financing: the funds, which are obtained for the financing of the crushing seasons, will be allotted to the mills in proportion to the sugar production quotas for domestic consumption in accordance with article 3(*a*). If a factory cannot reach the assigned production quota, a proportionate part of the Warrant fund must be returned to the respective financing institutions.

Article 9.—Promotion of domestic consumption: The National Commission for the Study of Cane and Sugar (CNECA) has to use up to 50% of its financial rescources for the promotion of the sugar consumption in the entire territory of Bolivia and especially in the Altiplano and the Departments of Beni and Pando.

Article 10.—All violations of the present supreme decree 07070 will be punished by the immediate suspension of the credits authorized under the "Warrant" programme as well as the stoppage of the sale of revenue stamps required for the control of the production of alcohol from molasses. As a last resort the permission to produce sugar and its by-products will be temporarily suspended.

The existing three mills started the current crushing season at the end of May and it is hoped that the implementation of the provisions of the decree 07070 will create a more efficient sugar industry in Bolivia and reduce the costs of production of sugar.



Factory research in Hawaii. *Rpt. H.S.P.A. Expt. Sta.*, 1964, 37–44.—From studies it is concluded that a centralized control system in a cane factory is feasible, although some equipment could not be incorporated, e.g. reciprocating steam engines, which would have to be replaced. Storage tests showed that despite the increase in the pol ceiling to 98·8, the Deterioration Factor [moisture/(100 – pol)] is still applicable, those sugars in the pol range 98·3–98·9 showing little loss at a Deterioration Factor of 0·25 and below, whereas deterioration becomes serious at a Factor value above 0·30. The feeder table control system at McBryde[1] has been provided with a jogging system to break up cane jams. The jogging is actuated by two feeler arms over the cascade washing conveyor; the arms sense the lack of cane and cause the feeder table to start momentarily regardless of motor load. The system has permitted the cane cleaner to operate more continuously than is possible with an on-off type. A single loop control system similar to that at McBryde and installed at Lihue has operated successfully, obviating the need for manual control of the No. 2 conveyor. It has been found that, other factors being constant, larger crystals contain more colour than small ones. Large, dark crystals were washed and ground to a powder which was then washed with methanol and syrup. The colour was reduced from 42·9 in the original crystals to 6·9 in the powder, indicating that 84% of the colour was released in this manner. While crystal colour increases with pH for all sugars, some show a greater increase than others at higher pH values. However, at about pH 10·5 the colour becomes constant, suggesting that measurement at this value would give a better indication of the quantity of colouring matter present than the currently used value of 7·0. Tests to determine the effect of beating on massecuites showed that incorporation of air increases the viscosity of massecuite and final molasses. The increase may exceed 30% and is approximately proportional to the quantity of air incorporated. Beating of massecuites has no apparent effect on the purity of molasses obtained from them. While the response of the automatic saccharimeter to clear sugar solutions is satisfactory, its use for in-line measurement of sugar streams has been limited by the insoluble solids which affect the readings. This material will have to be removed before the sample is passed through the instrument, e.g. by centrifuging or chemical clarification. Magnesium oxide was tested as a partial or complete replacement for lime in mixed juice clarification. Juice clarified with MgO produced less scale than when lime was used and the scale that was formed was softer than with lime. Even lime-MgO mixtures gave less scale than lime alone. The turbidity and colour of juice clarified with MgO were higher than when lime was used, while the mud volume was lower. While MgO costs more per unit of basicity than lime, it is economically attractive because of the reduced evaporator scaling and reduced costs of weekend cleaning. While tests with two Waters in-line continuous refractometers (one of them installed on the commercial sugar pan at McBryde) have demonstrated the possibility of using the instrument for factory control use, problems have been encountered in fouling of the prism face and zero drift. A technique of preparative electrophoresis followed by column chromatography has enabled large-scale fractionation of the principal colour substances in evaporator syrup to be carried out. Visible and u.v. spectrophotometry of the three isolated colour substances (reddish brown, brown and yellow) showed that the first two contained nitrogen, while the yellow complex had an absorption peak of 281 mμ. This has been ascribed by other workers to the presence of hydroxymethylfurfural caused by the destruction of reducing sugars, and, while it is a colourless compound, it has been reported to be a precursor of colour compounds. The insoluble matter in syrup was separated by ultra-centrifuging and fractionated into ether-soluble and -insoluble portions. The ether-soluble fractions consisted mainly of lipids, the organic matter being composed of a mixture of polysaccharide, polyphenol and nitrogen-containing complexes. The composition of the nitrogen complexes was characterized by the amino acid content as determined by hydrolysis and two-dimensional chromatography. In descending order of percentages, the following amino acids were found: glutamic acid > leucine and *iso*-leucine > aspartic acid > alanine > valine > glycine > proline, while the residual amino acids constituted 9·1%. The insoluble material separated by ultra-centrifuging from sugar crystal solutions and fractionated as in the case of the syrup material was found to contain virtually the same organic substances as the syrup material, although in an amount approx. double that in the syrup. The nitrogen content was also much higher, while the composition of the nitrogen complexes was similar. An experimental instrument has been constructed for measuring the degree of supersaturation of a sugar liquor in terms of the heat of solution. It comprises a single-body heating cell fitted with two thermistors; the cell is heated electrically and the temperature difference between the thermistors is measured by a bridge circuit and plotted against the sample temperature on an XY recorder. An analogue computer storing output signals from the bridge null detector is used for the plotting. The method shows

[1] *I.S.J.*, 1964, **66**, 360.

more promise than the conductivity method and the system has been refined to permit detection of temperature differences of less than 0·001°C over a range of 10°.

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The direct circulation vacuum pan. L. A. R. PINTO. *Sugar y Azúcar*, 1965, **60,** (3), 44–45.—A description is given of a new pan designed for low-grade strikes at Usina Santa Lydia (Brazil) based on the Hugot floating calandria pan but incorporating a series of deflecting rings above the calandria, the diameter of which is kept as low as possible. The vapour generated is contained in the vertical cylinder formed by the deflecting rings and creates an upward pressure that increases circulation and helps push the massecuite up the cylinder while the vapour-free massecuite outside the cylinder sinks slowly and uniformly to the calandria bottom. A 16,000-litre pan of 5·58 sq.m. h.s. gave a 59·5 purity 93·5°Bx *C*-product boiled on a 61°Bx syrup of 84·5 purity fed with 60°Bx molasses. The boiling time was 4 hr 10 min.

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A case for the cleaning of second carbonatation juice heater by fermented molasses wash. A. C. KHORANA and S. C. JAGGI. *Indian Sugar*, 1965, **14,** 673–675. The 2nd carbonatation juice heater at Malwa Sugar Mills was de-scaled by filling two-thirds of the total juice space with a 15°Bx molasses solution to which ammonium phosphate, sulphate and bifluoride and sulphuric acid had been added and filling the remaining one-third with a fermented molasses wash prepared by inoculating molasses with yeast culture (the yeast converts the invert sugar to ethyl alcohol and CO_2 which then reacts with the scale constituents). Fermentation was then allowed to continue for 8 days after which the wash was drained off and the tubes cleaned with electric brushes. The advantages of the method include reduction in labour and materials (scrapers and brushes).

* * *

Factory production of whole sugar. E. JOURDAN. *Rpt. Inst. Recherches Agron. Madagascar*, 1964, 43–47. Tests have been carried out on the production of cane sugar on a small factory scale as opposed to the present production on a cottage industry scale in Madagascar. A fixed-opening, 3-roller mill with an hourly throughput of 300 kg of cane was used for juice extraction. While addition of milk-of-lime gave a firmer sugar of better crystallization properties and prevented or reduced sucrose inversion, it also caused browning of the final product and made it somewhat bitter. Liming to pH 7·0 gave a distinctly black sugar, while at pH 6·4 the sugar had a deep chestnut colour. Details are given of the boiling process, cooling and dropping of the massecuite; the striking point is determined by pouring a small quantity of the syrup into cold water and seeing if it forms a solid mass. The sugar obtained is not all crystalline and further tests are to be made to produce a true crystal sugar.

Application of ion exchangers in sugar manufacture. K. ČÍŽ. *Czechoslovak Heavy Ind.*, 1965, (4), 32–38. A survey is presented of the use of ion exchange resins for demineralization and decolorization of sugar factory and refinery products, with information on the Czechoslovak "S" strongly acidic cation exchanger and a summary of the economic advantages of ion exchange treatment.

* * *

The sugar industry in Fiji. ANON. *Australian Sugar J.*, 1965, **56,** 759–761.—A brief illustrated account is given of the industry which is centred on 4 mills producing about 300,000 tons of sugar in 1964. Cane is grown on about 13,000 small farms each averaging 10 acres.

* * *

Colour problem of raw sugar for (the) export market. S. C. GUPTA. *Indian Sugar*, 1965, **14,** 719–729. Comparison of Indian raws with others from different sources by Japanese sugar refiners showed their main defect to be high colour. The nature of colouring matter in cane, juice and sugar is discussed and the opinion held that caramel is the major factor in sugar colour. It is proposed that additional phosphate be added to clarified juice to inhibit reducing sugars destruction during evaporation and crystallization, and thus lessen caramel formation and sugar colour.

* * *

Boiler scaling problem in sugar factories. C. CHANDRASEKARAN and S. K. KULKARNI. *Indian Sugar*, 1965, **14,** 731–733.—The necessity for adequate treatment of raw water, to be used for modern high-pressure bent-tube boilers, is emphasized. A number of methods of treatment are briefly described, including that of the authors' factory, analytical data from which are tabulated.

* * *

Governor systems—control systems—each has specific operation. W. L. BERGERON. *Sugar J.* (La.), 1965, **27,** (10), 58–64.—A description is given, with illustrations, of various types of governor systems applied to Elliott steam turbines.

* * *

Improvements to Guánica factory. R. F. GOODWIN. *Sugar J.* (La.), 1965, **27,** (10), 72.—New equipment and changes in techniques introduced for the 1965 crop at Central Guánica are described.

* * *

Central El Palmar. F. CORDOVEZ Z. *Sugar J.* (La.), 1965, **27,** (10), 73–75.—A brief account is given of this Venezuelan sugar factory together with a list of the machinery installed.

320 years of problems. M. MOORE. *Sugar J.* (La.), 1965, **27,** (10), 78–83.—A description is given of the island of Antigua and the history of its sugar industry, together with an account of current practices, an extract from the Chairman's Statement to the Antigua Sugar Factory Ltd. in August 1964, and graphs and tables of rainfall and sugar yield, and sugar exports from 1824 to 1838.

* * *

Plata installs unique mill drive turbine. ANON. *Sugar J.* (La.), 1965, **27,** (10), 91.—A steam engine at Plata Sugar Co. in Puerto Rico has been replaced with a 3550 h.p. multi-stage Terry steam turbine which operates on steam at 150 p.s.i.g. and 50°F superheat, against 20 p.s.i.g. back-pressure. It is believed to be the largest mill drive turbine ever installed.

* * *

Combined grinding and continuous diffusion. A. F. DE LA CALLE. *Sugar y Azúcar,* 1965, **60,** (4), 18, 21, 147.—Arguments are presented for the adoption of diffusion in place of milling in Mexican sugar factories, and claims made for the superiority of the author's diffuser, the development and current design of which are described.

* * *

A few useful details for vacuum pans. A. L. WEBRE. *Sugar y Azúcar,* 1965, **60,** (4), 36, 38, 40.—An illustrated description is given of an adjustable vacuum limit valve which may be made easily and cheaply in a factory workshop and which serves as a vacuum controller for a vacuum pan. Also described is a technique for adding seed as a slurry to a pan without blocking the entry orifice, dissolving the crystals, or admitting air. The use of a spring vacuum gauge with a double-scale absolute pressure gauge is advocated for measurement of absolute vacuum in pans instead of a mercury vacuum gauge.

* * *

Peru's new raw sugar bulk loading facility. ANON. *Sugar y Azúcar,* 1965, **60,** (4), 56, 58.—An illustrated description is given of the bulk sugar terminal at Salaverry, Peru, where the harbour has been extended and a new reception, storage and loading facility installed. Sugar from three nearby mills is delivered by trailer trucks, which are weighed full and empty, and then carried by a Buhler conveyor-elevator system to a storehouse, maximum intake rate being 200 tons/hr. Removal is by means of a tunnel in the floor into which the sugar falls under gravity or is pushed by a bulldozer. A belt conveyor/chain conveyor takes the sugar to adjustable booms carrying telescopic loaders which deliver at up to 600 tons/hr into the holds of the bulk sugar vessel.

* * *

The effect of electrically driven mills on the heat balance of the factory. C. G. M. PERK. *S. African Sugar J.,* 1965, **49,** 267–275.—Development of electric drives for mill tandems is reviewed. Heat consumption calculations are made for two 18-roller 200 t.c.h. tandems, one driven by individual single-stage turbines and the other by the most modern type of electric motors. The former uses less power because of the triple conversion of heat to electrical energy to mechanical power instead of the double conversion with the turbine; however, the difference is more than compensated by the higher radiation losses from six turbines and steam pipelines than from the single power-house turbine, and also the large amount of exhaust steam which may be an embarrassment and source of heat loss if blowing-off needs to be practised. Calculation of steam balances shows that 53% steam on cane is required for the turbine-driven mill, compared with 45% for the mill with electric drive.

* * *

A practical guide to boiler water control. E. OGASAWARA. *Rpts. Hawaiian Sugar Tech.,* 1964, 40–41.—A guide to undesirable conditions, their effects, causes and treatment is provided, covering boiler water, steam and boiler feed water.

* * *

Maintenance welding in the sugar industry. J. MARDEN. *Rpts. Hawaiian Sugar Tech.,* 1964, 42–43. Preliminary judgements as to joint design, the type of welding process, pre-heating or post-heating, welding materials to be used, etc., are required to permit greatest benefit to be obtained from welding as a technique to reduce maintenance costs.

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Progressive modernization of the milling station. T. A. FREGEAU and A. D. WILCOX. *Rpts. Hawaiian Sugar Tech.,* 1964, 49–58.—Arguments are presented for and against replacement of an old mill by a new tandem of higher capacity, and the advantages and disadvangates of progressive modernization, i.e. over a period of years, discussed. Means of achieving higher extraction are reviewed as are ways of increasing capacity. Consideration is given to specifications for turbines and gearing for mill drives.

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Machine reliability—a matter of life and test. M. R. BENNETT. *Rpts. Hawaiian Sugar Tech.,* 1964, 59–60. The importance of durability, as well as performance, of a machine is emphasized using development of an imaginary new concept and its testing as an example.

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Continuous centrifugals for raw sugar. W. R. AZEVEDO. *Rpts. Hawaiian Sugar Tech.,* 1964, 73–74.—Modifications to a continuous centrifugal supplied by Silver Engineering Works to Hawaiian Agricultural Co. are described in an effort to avoid caking of fine sugar inside the casing wall or on the rubber shroud originally fitted. The caking problem was solved eventually by enlarging the casing diameter from 63 in to 104 in at its upper end. Improvement of throughput was achieved by changing from a 30° to a 26° basket, and the machine acted as a pattern for a battery of three centrifugals built for Peepeekeo where good results have been obtained.

The economic effect of installing vacuum filters based on the example of Pruszcz sugar factory. J. KISIELNICKI. *Gaz. Cukr.*, 1965, **73,** 31–34.—The monetary savings resulting from the installation of Škoda vacuum filters of 30 sq.m. filter surface in place of Kroog filter presses for 1st carbonatation mud treatment are discussed. Among the improved results obtained are increased throughput and sugar yield on beet, the sugar losses in mud being 0·07% on beet in 1963/64 (the first campaign with the vacuum filters) compared with 0·13% and 0·15% in 1961 and 1962 respectively. Savings also resulted from reduced labour requirements and filter-cloth usage.

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New carbonatation method for raw juice purification. S. VOLF and L. SLAVIC. *Cukoripar*, 1965, **18,** 1–3. Details are given of the juice purification scheme at Novi Sad sugar factory[1] which has given a juice settling rate greater than 10 cm/min and a filtration coefficient (F_k) of < 3.

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Treatment of low-grade massecuites. A. PASETTI. *Ind. Sacc. Ital.*, 1965, **58,** 22–28.—The various methods and formulae used as criteria for low-grade massecuite exhaustion are surveyed, and mention is made of the modern tendency to maintain a high supersaturation while the massecuite is in the crystallizer, reducing it just before the massecuite passes to the centrifugal.

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Automation of a beet sugar factory. J. G. ZIEGLER. *Rpts. Hawaiian Sugar Tech.*, 1964, 44–48.—A detailed account is given of some of the automatic controls installed in the new Holly Sugar Corporation plant at Hereford, Texas, U.S.A.

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Efficacy of a high supersaturation of mother liquor on the exhaustion of low-grade massecuite. A. PASETTI. *Ind. Sacc. Ital.*, 1965, **58,** 75–84.—Contrasting views expressed in the literature as to the best degree of supersaturation to obtain maximum exhaustion are reviewed and discussed. Experiments carried out by the author are reported; these confirm the view of GRUT[1] that as high a supersaturation as possible is required, the advantages outweighing the difficulties due to the associated high viscosity.

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Influence of temperature and stirring on the crystallization of sugar. A. V. ZUBCHENKO. *Izv. Vysshikh Ucheb. Zaved., Pishch. Tekhnol.*, 1964, (5), 73–75; through *S.I.A.*, 1965, **27,** Abs. 147.—Sugar solutions of 1·9–2·37 supersaturation at 40–70°C were prepared by boiling and cooling, and were crystallized in a laboratory horizontal mixer stirred at 600 or 1200 r.p.m. The size distribution of the crystals in the resulting mass was determined with a microscope. Increasing the supersaturation (by lowering the temperature) and increasing the stirring speed both led to the production of more fine crystals and fewer coarse crystals, and to a slight increase in the total crystal yield. At constant supersaturation, an increase in temperature of 10°C caused the peak of the size distribution function to shift to a larger crystal size, without affecting the numbers of the finest and coarsest fractions.

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Automation of evaporators. V. D. POPOV, V. G. TREGUB, K. A. UTKINA, S. I. SIRENKO and E. A. YATSENKO. *Izv. Vysshikh Ucheb. Zaved., Pishch. Tekhnol.*, 1964, (5), 115–118; through *S.I.A.*, 1965, **27,** Abs. 163.—An alternative to the "hungry régime"[1] is suggested, whereby the vapour take-off and the quantity evaporated are equalized at their average values, and any evaporation in excess of vapour demand is taken off to an "independent consumer", e.g. a steam jet compressor for 2nd effect vapour. A control scheme is described for a quadruple-effect evaporator followed by a concentrator. Greater stability is achieved by measing the juice density at two points: after the 2nd effect and after the concentrator. These measurements respectively control the operation of the compressor and the vapour supply to the concentrator. Steam is supplied to the 2nd effect vapour space in the event of a deficiency of vapour. Regulation of the overall temperature head across the evaporator is used only to compensate for changes in heat transfer coefficient or thin juice flow rate and/or Brix.

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Waste waters from a beet factory. Oxidation of oxygen-demanding material in a biological (storage) tank. D. G. CHRISTENSSON. *Socker Handl. 1*, 1964, **20,** 43–61; through *S.I.A.*, 1965, **27,** Abs. 165.—A study of the purification of beet wash waters in the 1963 campaign at a Swedish factory is reported in detail. Forced aeration was investigated by means of a horizontal turbine propeller and an air blower mounted on a floating raft in an experimental tank of 1·3 m depth. It was found that the rate of oxidation increased with the water temperature, and hence the rate of air supply should not exceed a limiting value determined by the temperature; it was therefore impossible to purify the water in an aerated tank during the campaign, since a temperature of >20°C during three months is required. The turbine propeller (in the form of a horizontal wheel with attached blades) was more effective than the blower, but a combination of both in which the lower outlet directed

[1] QUENTIN: *I.S.J.*, 1965, **67,** 53.
[1] *I.S.J.*, 1954, **56,** 19.
[1] *I.S.J.*, 1965, **67,** 248.

air upwards from below the turbine was particularly effective in maintaining an O_2 concentration of 6 mg/litre in the water. This level is regarded as the minimum for effective degradation of impurities. The calculation of the required power for the turbine and/or blower according to the temperature of the water is explained. Curves showing the progressive reduction of the $B.O.D._5$ are reproduced. A maximum $B.O.D._5$ was found at a sucrose concentration of 0·1% in the water; at higher concentrations the $B.O.D._5$ decreased, but a higher $B.O.D._{10}$ was recorded. A maximum development of bacterial colonies was found at 0·1% sucrose. It is suggested that waste waters should be aerated to high levels of dissolved O_2 before discharge, to compensate for residual B.O.D. in the waters; the same procedure could be applied to natural waters either above or below the point of discharge.

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Data processing in the Danish sugar industry. O. E. LENAU. *Proc. 32nd Conf. Queensland Soc. Sugar Cane Tech.*, 1965, 15–19.—A detailed description is given of the Bull punched-card system employed by the Danish Sugar Corporation whereby each beet grower has a reference number which is marked on the card for every delivery, the cards being punched in accordance with the gross and tare weights of the load, dirt tare and pol content. The value is then credited to the grower's account while a similar set of punchings are used for the pulp returned to the grower as well as beet seed, fertilizer, molasses, and lime cake supplied by the Corporation. The growers' accounts are closed immediately after the end of the campaign.

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Ultrasonic method of controlling the basic technological processes in beet sugar production. V. M. LUBE, E. N. BESSONOVA, A. M. DONETS and YU. BALASHOV. *Sakhar. Prom.*, 1965, **39**, 248–252.—Tests were carried out to determine the dependence on temperature and density of the speed of ultrasonic waves in raw juice, 2nd carbonatation juice, thick juice from the evaporators and milk-of-lime. The concentration-velocity relationship was linear in all cases for the concentration range 7–16°Bx (a 1°Bx change in concentration being accompanied by a 4 m/sec change in velocity) and for the range 35–60°Bx (a 1°Bx change in concentration corresponding to a 6 m/sec change in velocity). In the case of milk-of-lime, there was negligible velocity change at a density change in the range 1·15–1·22 g/c.c. In all cases the temperature-velocity relationship was not linear, the character and slope of the curves depending on density. Generally, the velocity increased with temperature to a maximum, remained fairly constant at 40–70°C (thick juice), 60–70°C (raw juice and carbonatation juice) and 70–80°C (milk-of-lime). Hence, the use of a thermostatically-controlled primary element at a temperature no higher than 70°C is recommended to give results within experimental error.

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The KDA-25-59 continuous tower diffuser. E. T. KOVAL', V. G. YARMILKO and V. YA. VAILOV. *Sakhar. Prom.*, 1965, **39**, 256–261.—Details are given of the Soviet KDA-25-59 tower diffuser which includes a shaft with vanes rotating at up to 0·6 r.p.m. At Gorodenkovskii sugar factory losses in diffusion in the second half of 1963 averaged 0·31% at a juice draught of 121·5% and a throughput of 1560 tons of beet per day. In the corresponding period of 1964 the losses were approximately 0·20% at a throughput of 1630 tons of beet per day and a draught of approximately 122–124%.

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Multi-stage scheme for juice purification. A. I. KATANA. *Sakhar. Prom.*, 1965, **39**, 261–265.—Results obtained at Timashevskii sugar factory, which uses the BMA carbonatation scheme, were compared with those at other Soviet factories using the conventional scheme. While the settling and filtration rates and mud sugar content were better, the colour of 1st and 2nd carbonatation and thick juices was higher, as were molasses yield and sugar content and white sugar colour, than at the other factories. Certain recommended measures to increase the efficiency of the BMA scheme are briefly discussed.

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Check filtration of 1st carbonatation juice. V. L. MAR'YANCHIK and E. V. LITVINOV. *Sakhar. Prom.*, 1965, **39**, 266–269.—Check (secondary) filtration of 1st carbonatation juice is considered unnecessary where leaf filters are used for primary filtration of 1st carbonatation juice and where 1st carbonatation juice is treated by vacuum filters in conjunction with settlers or leaf-type thickeners. If thickeners and secondary filtration are used, the number of thickeners should be halved and the juice retention in the thickener reduced to 1–1½ hr, thereby helping to reduce losses of sugar and heat and filter-cloth usage and accelerate filtration while increasing juice quality.

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Operation of Alma-Ata sugar factory without evaporator boiling-out during the 1964/65 campaign. S. I. VASHCHENKO. *Sakhar. Prom.*, 1965, **39**, 270.—After 130 days, the quintuple-effect evaporator was found to be in such a good state that no boiling-out was required, unlike the carbonatation vessels which were heavily scaled. Secondary filtration is used after vacuum filtration and a temperature of 102°C is maintained in the juice reheater after 2nd carbonatation. In other Kazakh sugar factories not equipped with vacuum filters evaporator boiling-out has been found necessary.

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Criteria for optimization of the control of an automated sugar factory. E. K. SHIGIN and P. M. KAZ'MIN. *Sakhar. Prom.*, 1965, **39**, 274–279.—A number of expressions are presented which define the costs involved in each process in terms of quantitative factors and/or losses. By measuring the various factors and feeding the information to a computer which would in turn feed command signals to individual regulators or to a main control circuit, it is considered possible to maintain optimal conditions in each

process as regards costs. The information fed to the computer may be in the form of separate pieces of information obtained stepwise by "optimizers", or the parameters may be calculated from the formulae given. Some of the relationships have been expressed in graph form and a mathematical scheme is presented showing the loss and cost factors from diffusion to the finished sugar product.

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Experience in the unloading of road trailer units on side-tipping platforms of beet pilers. V. A. NOVIKOV and N. M. KICHIGIN. *Sakhar. Prom.*, 1965, **39**, 271–274.—The advantages of unloading beet from road trucks and trailers by means of side-tipping platforms are discussed with the aid of two illustrations showing both the truck and subsequently its trailer being unloaded on a Komplex-3-TsINS side-tipper without unhitching the trailer. The use of trailers (one or two per train) is advocated since the trailers replace trucks needed for longer journeys.

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Measurement of milk-of-lime delivery. A. L. ANTONOVICH. *Sakhar. Prom.*, 1965, **39**, 279–280.—A manometer with a chart graduated in units of milk-of-lime delivery is connected to the air feed line of the cone valve device described earlier[1]. Since the aperture and manometer reading are linearly related, the manometer will give milk-of-lime delivery at constant density up to a value no more than half the maximum flow. An expression is given for calculating the correction to be applied with variation in density.

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Alteration in sugar losses in molasses as a result of cation exchange. T. P. KHVALKOVSKII. *Sakhar. Prom.*, 1965, **39**, 285–288.—The melassigenic coefficients of 24 non-sugars in molasses were determined. The values for the six basic non-sugars (K and Ca salts) were compared with the product of gram-equivalents and reduction in the amount of bound sugar in standard molasses when one equivalent of Ca^{++} replaces one of K^+ was determined. Analogous comparisons were made for Na^+ and Ca^{++} salts with the same anions. The results show that complete replacement of K^+ and Na^+ by Ca^{++} cations will reduce the sugar content in molases by 11·43% or 23·4 % on the original sugar content. Calculation of the extent to which the reduction in sugar losses may fluctuate, using alkaline ash measurements made by SILIN on 17 molasses samples, showed that the sugar loss may be reduced by 13·8–30·8% for an alkaline ash range of 4·92–11·01%. By replacing K^+ and Na^+ with Mg^{++} ions, the molasses sugar content can be reduced by a total of 28·3% on the original sugar content. This compares with a range of 16·7–37·3% calculated from the SILIN alkaline ash determinations. Discrepancies between the results obtained and values found by MOEBES[2] and QUENTIN[3] are explained by the high alkaline ash content in West European molasses, and possibly by a certain additive effect caused by precipitation of almost insoluble Ca and Mg salts, as well as the effect of anion composition. Softening of juice by replacing Ca^{++} ions with Na^+ has been calculated, from the product of the gram-equivalents of the basic non-sugars as above, to cause a slight increase in molasses sugar.

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Processing beet tails at Kanevskii sugar factory. V. A. RADCHENKO. *Sakhar. Prom.*, 1965, **39**, 290–291. Tails and other impurities fall through gaps between the rollers over which beets pass to the washer. The tails are separated from the other impurities, washed and crushed; the water is separated from the tails in a screw press, while the tails are weighed and fed to diffusion together with the cossettes.

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Useful suggestions. I. YA. GORBULIN. *Sakhar. Prom.*, 1965, **39**, 292–293.—These include a deflection plate to prevent emulsion used to wash a TG-80-1,6 gas blower from entering the bearings; a sand trap in which the sand, having dropped through grids from the flume into one of two bunkers and then via a gate valve, is continuously removed from a collector by a stream of water; and a means of fixing a valve to an axle pin.

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Batch method of softening thin juice with cation exchange resin. J. BURIÁNEK and D. MAREŠOVÁ. *Listy Cukr.*, 1965, **81**, 53–58.—Removal of Ca^{++} ions from thin juice by a cation exchange resin in Na^+ form ("Lewatit S-100") was investigated on semi-plant scale. After 72 hr ion exchange treatment, the juice was sent to an evaporator in which untreated juice had been evaporated for 72 hr. The softened juice dissolved 12 kg of lime (equivalent to 60 kg of dissolved scale) in 20 hr, the remainder of the scale being dissolved in 12 hr. This indicates that the scale was dissolved six times faster than it was formed. Regeneration tests showed that the optimal NaCl concentration was 10%. It was found that where the lime content in juice was maximal, the colour content and dissolved oxygen were minimal.

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Experiences with a non-ionogenic antifoaming agent for the sugar industry. H. ROTHER. *Zucker*, 1965, **18**, 232–236.—Details are given of tests in which a synthetic antifoaming agent was compared with four others and found to have more favourable effect than these with molasses solutions, and raw and defecation juice. It is claimed to be effective in evaporators since it is not destroyed by heat. It does not affect the capacity of ion exchange resins, is neither toxic nor corrosive and does not block pipelines, valves, etc. In crystallization the major part of the agent remains in the run-offs.

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Magnetic water treatment for scale and corrosion prevention. H. ANDERS. *Zucker*, 1965, **18**, 236–238. Boiler-feed treatment by such processes as the CEPI (Conditionnement Electromagnétique par Induction) is discussed and some advice given as to the means of obtaining maximum effect.

[1] *I.S.J.*, 1964, **66**, 266.
[2] *ibid.*, 1958, **60**, 238.
[3] *ibid.*, 174.

F. O. Licht's Internationales Zuckerwirtschaftliches Jahr- und Adressbuch 1964/65 (International Sugar Economic Yearbook and Directory). H. AHLFELD. 444 + 60 pp.; $8\frac{1}{2} \times 11\frac{1}{2}$ in. (F. O. Licht K.G., P.O.B. 90, 2418 Ratzeburg, Germany.) 1965. Price: DM40; 72s 6d.

Once again the time has come round for a new edition of this well-known publication. The standard remains high—there are minor faults, but with such a detailed work these are to be excused. For those unacquainted with the book, the contents can be summarized as follows: sections on laws, agreements and contracts, German and other sugar organizations, sugar importers and exporters in Europe and other continents, details of German beet sugar factories and refineries, European and other non-European beet factories and refineries (except China), and cane sugar factories and refineries (again with the exception of China). There are three technical articles, a survey of the German sugar equipment and factory construction industries and reports from German sugar equipment and factory manufacturers. There is a Buyers' Guide, an English-German vocabulary and a selection of sugar publications with publishers' addresses. The information has been brought up to date and a welcomed introduction is the list of Soviet sugar factories and refineries and Soviet sugar organizations. This time there is no atlas of sugar-producing countries. Even if the other most useful information were not included, the details provided on the world's sugar factories and refineries alone would make Licht's Yearbook a valuable acquisition.

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Technology of Beet Sugar Production and Refining. P. M. SILIN. Transl. L. MARKIN. 482 pp.; $7 \times 9\frac{3}{4}$ in. (Israel Programme for Scientific Translations, Jerusalem; Oldbourne Press, 1–5 Portpool Lane, London E.C.1.) 1964. Price: 135s 0d.

This is a translation of a book first published in the Soviet Union in 1958 and much referred to in Soviet sugar literature. It is divided into eight main sections with many subdivisions, and covers beet sugar technology, beet sugar refining, the history of sugar manufacture and the chemistry of sugar. It also contains information on by-products utilization. The introductory pages on the origins of the beet industry and the history and development of beet processes and equipment appear somewhat tendentious and many claims are made for Russian inventions that may or may not be justifiable. However, the book is useful, if only to give a picture of the practices in the Soviet Union. It certainly does not give particularly valuable information to the sugar technologist in Western Europe and the U.S.A. because of the time lag between the original publication and its translation and because much of the equipment used in Soviet factories would be considered old-fashioned in western factories, and references to Western European equipment are sometimes inaccurate in places. As regards the translation, this is adequate but not excellent and the work is obviously that of a person whose mother tongue is not English and who is obviously not *au fait* with sugar industry or equipment. It might be felt that the cost and labour involved in the translation have been in vain; certainly the price of the book is high, particularly for a work that would probably have little demand even if it were up to date as regards the Soviet industry.

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Sugar Year Book 1964. 326 pp.; $3\frac{1}{2} \times 5\frac{1}{2}$ in. (The International Sugar Council, 28 Haymarket, London S.W.1.) 1965. Price: 20s. 0d.

There are 28 more pages in the 18th edition of this useful collection of sugar statistics than in the previous edition, 16 more countries being represented to bring the total to 113. The statistics include world centrifugal sugar production in metric tons, expressed, where possible, as 96 pol raw sugar and tabulated in alphabetical order by countries. Tables of more general information are also included, viz. world sugar production, imports and exports, sugar stocks and consumption (absolute and per caput) during the period 1958–64, world sugar prices 1952–64, British Commonwealth Sugar Agreement export quotas 1964–65, United States sugar quotas 1963 and 1964, retail prices of white refined sugar in selected countries as on 1st January 1964 and 1965, and equivalent weights and measures. All this information is available in a book that really is pocket-size and yet in which the tables are highly legible.

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pH en el Azúcar (pH in sugar). J. C. RAMÍREZ. 389 pp.; $5\frac{1}{2} \times 8\frac{1}{4}$ in. (J. C. Ramírez, Eugenio Sué No. 316, México, D.F.). 1964.

The technologist who expects this work to be concerned with hydrogen ion concentration in sugar juices, etc., is likely to be surprised by its contents which are concerned with the Mexican sugar industry, its history, development, present status, future and relationships with other countries, all being discussed at length, with copious appendices of statistics, graphs and reproductions of letters and pages from books from as far back as 1756.

LABORATORY METHODS AND CHEMICAL REPORTS

Sucrose diffusion in aqueous solution. D. SCHLIEPHAKE. *Zucker*, 1965, **18**, 138–142.—The schlieren method was used to determine the diffusion constant of aqueous sucrose solutions in the temperature range 20–70°C and concentration range 10–65% by weight. The values obtained agree well with those obtained by ENGLISH & DOLE[1] for a much smaller temperature and concentration range. As indicated by the author previously[2], in the low concentration range (below 30–40%) the hydrate structure is the most dominant, while above this concentration an associate structure is formed, the molecular movement of which does not conform to the Einstein-Stokes law. The boundary between these two structures is not static and with increase in temperature it occurs at higher concentrations. At very high concentrations the associate becomes a type of melt. With the hydrates, the activation energy is only stlightly dependent on concentration, whereas with the associates the activation energy is considerably dependent on concentration. With the melts, there is very little diffusion movement and the dependence on temperature is considerable.

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Detection of non-reducing carbohydrate compounds with complex cuprates (III). J. KOCOUREK, M. TICHÁ, J. KOŠTÍŘ and L. JENŠOVSKÝ. *J. Chromatogr.*, 1964, **14**, 228–231; through *S.I.A.*, 1965, **27**, Abs. 52.—A solution of potassium tellurateocuprate (III), prepared according to the method of BONNER[3] with substitution of potassium tellurate for periodate, is a sensitive spray reagent for sugars on chromatograms. Sucrose and other non-reducing oligosaccharides were detectable at 5–10 μg. The anion $[Cu(TeO_6)]^{9-}$ is a powerful oxidizing agent. The spots are revealed as white on a transient yellow-brown background; the pattern may be stabilized with rosaniline or TTC solution.

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Thermophilic micro-organisms in refined sugar and refinery products. V. M. KATS, V. Z. NAKHODKINA and L. A. KOROBEINIKOVA. *Sakhar. Prom.*, 1965, **39**, 168–172.—The numbers of thermophiles in raw and refined sugar and intermediate products were determined at two refineries. The non-H_2S-forming anaerobes were only determined qualitatively. H_2S-forming bacteria were found in the sugars of only one refinery. Although fluctuations occurred from month to month, no relationship was established between time of year and thermophile counts. When the count in the raw sugar was very high, it was very low in the refined sugar obtained from it, although this is considered coincidental. In Cuban raws the thermophile count was not always greater than in the refined sugar from it, contrary to reports in the literature. Affined raw sugar re-melt liquor had a thermophile content below the maximum permitted level; after affination the major proportion of the thermophiles remain in the run-off. Flat-acid thermophiles occurred in remelt liquor and also in filtered 2nd refined liquor in numbers below the maximum permitted level. Hence, these sources are not responsible for any increase in the contamination of subsequent products. Sometimes the thermophile content in refined sugar was found to be higher than in the raw sugar. Bone char or active carbon treatment of liquors reduced the thermophile count from 1095 to 265 per 10 g. While curing reduces the thermophile counts, there are a number of possible sources of infection which tend to offset the effect, e.g. massecuite residues in the crystallizer trough, on the centrifugal covers, etc. Further investigations showed that after packing, the thermophile counts rose from 40 to 600 per 10 g. Samples of jute sacking revealed considerable numbers of thermophiles; these were greater with used than new sacks. Polyethylene samples were almost free of germs. Sugar stored from December to April in jute and polyethylene bags in an unheated warehouse contained fewer thermophiles at the end of storage than initially, the counts being 40, 1 and 25 per 10 g in jute, polyethylene (throat tied) and polyethylene (throat screwed) respectively, compared with 80 per 10 g at the start of storage.

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Alteration in the amount and concentration of colouring matter during production. F. N. DOBRONRAVOV. *Sakhar. Prom.*, 1965, **39**, 173–175.—The colour content of juices and products has been found to vary according to the length of the campaign, a sharp rise at the end of the season being caused not only by accumulation of colouring matter during processing but also by the processing of stale beet. A balance of the colouring matter in factory products was drawn up at Novo-Troitskii sugar factory. The colour content rose from 44°St/100 Bx in 1st carbonatation juice to 126·4°St in the thick juice after evaporation. Causes of the increase were decomposition of reducing substances in 2nd carbonatation and sucrose decomposition and caramelization during prolonged evaporation. The concentration of colouring matter in the thick juice also increased as a result of reaction between invert sugar and amino acids and ammonia with the formation of strongly coloured melanoidins. Sulphitation of re-melt liquor was ineffective, reducing the colour content by only 10%. In the prolonged 1st massecuite boiling (over 5 hr) the colour rose by 7% as a result of reaction between sucrose and amino acids. The colour of the 1st product massecuite was 121·7°St and that of the white sugar 2·4°St. In 2nd massecuite boiling there was a rise of 118·3% in the colouring matter concentration caused by prolonged boiling (11–17 hr) at a high temperature (87–94°C). The various increases and decreases throughout production are illustrated by a diagram and the data are tabulated.

[1] *J. Amer. Chem. Soc.*, 1950, **72**, 3261.
[2] *Zucker*, 1963, **16**, 523; *I.S.J.*, 1964, **66**, 161.
[3] *Chem. & Ind.*, 1960, 345.

Instrument for automatic measurement of sugar syrup density using an RRP-605 radio-isotope density relay. L. N. KUZ'MENKOV. *Sakhar. Prom.*, 1965, **39**, 185–187. γ-Rays from a radio-active source pass through the juice feed pipe of an evaporator to a detector. Where the meter is intended as a device for use in an automatic control system, if the density deviates from a desired value, the mean impulse count rate alters, producing a signal proportional to the density deviation. The device is not sensitive to voltage fluctuations or humidity and temperature changes.

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Chromatographic analysis of the mixtures of sugars in sugar factory products. N. A. ARKHIPOVICH, L. M. ZELENINA and S. N. KVITA. *Sakhar. Prom.*, 1965, **39**, 197–203.—The micro-method described is based on that used by HAGEDORN & JENSEN to determine glucose based on the reduction of alkaline ferricyanide solution. To a sugar solution is added 2 ml of 0·005N potassium ferricyanide. After 15 min heating on a hot-water bath, the flask containing the sample is cooled and 3 ml of potassium iodide solution containing zinc sulphate (the latter prevents the solution deteriorating) added. The solution is acidified by adding 2 ml of 3% acetic acid, and 2 drops of starch solution are then added before titration with thiosulphate. The relationship between the amount of oxidizing agent consumed and the amount of sugar present has been determined for sucrose, raffinose, glucose, fructose and kestose and the formulae are given. For qualitative determination by paper chromatography, 7:1:2 *n*-propanol:ethyl acetate: water is used as solvent and the chromatogram developed with a solution made up of 100 ml *n*-butanol with 0·5 benzidine (preferably basic) and 10 g trichloracetic acid added. Full details are given of the techniques for qualitative determination and for quantitative determination by elution of the chromatogram. The method is based on a sucrose content not exceeding 400 μg. Thick products are diluted to about 20°Bx before determination (the test samples including 30–35 g syrup, 25 g molasses and 20 g massecuite, all made up to 100 ml). The volume of glucose and fructose solutions is made up to 5 ml before further determination by the Hagedorn & Jensen method. For raffinose determination, the eluate is made up to 5 ml and 0·5 ml of 25% HCl or 1·9 ml 2N HCl added, corresponding to the quantities of HCl used for inversion. For elution of the sucrose spots, the paper is cut into two strips and both eluted in one flask containing 20–30 ml solution. The total sucrose content per spot is then determined against purity and 5 ml of the solution transferred to a 50-ml flask to which is added the HCl as in raffinose determination. A parallel blank test is carried out to determine the reducing properties of the substances passing into solution when the paper is washed, in order to check the titres of the working solutions. The relative error of the method is about 1·5%.

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An investigation into the requirements for direct analysis for sugar cane. E. J. BUCHANAN. *S. African Sugar J.*, 1965, **49**, 145–161.—The basic requirements of a reliable sampler for cane consignments are outlined and tests described in which quality deviations within consignments were determined and cold extraction compared with hot extraction for cane sucrose determination. Three 1-cu.ft. (approx. 15 lb) samples per consignment (at the beginning, middle and end of each) were collected in boxes on a shelf built into the cane carrier housing after they had fallen through a hand-operated slide hatch. The mean % deviation in sucrose content was approx. the same as the value given by the Java ratio, 80% of the results having a value less than or equal to 5% deviation. On the basis of these results, a sampling procedure was developed in which 10 1-cu.ft. samples per consignment are collected below the shredder by an automatic sampler comprising a reciprocating plate which diverts the shredded cane from the shredder anvil onto a belt conveyor feeding a disintegrator. A secondary cutter is located below the discharge screw from the disintegrator. This is intended for further sampling of the free-falling cane from the screw. A screw conveyor below the discharge screw is provided for return of the primary sample to the main carrier. Cold extraction was carried out with a special apparatus which homogenizes 1000 g of cane with 2000 g of water in 15 min by means of knives mounted on a vertical shaft rotating at 6000 r.p.m. This was compared with the standard hot extraction procedure, cane for both being prepared with a Jeffco cutter-grinder, and the extracts polarized with a 400-mm tube. The final extract temperature increased with extraction time and probably gave a higher result while a 1000-g sample gave a higher result than did a 500-g sample. It is suggested that thicker slurries are better disintegrated than thinner slurries. Omitting sodium carbonate did not affect the results significantly, particularly with reduction in the extraction times. There was no difference between the values given by the hot and cold methods at 30 min extraction, but the mean differences increased with reduction in extraction time and were greater with a 500-g sample than a 1000-g sample.

* * *

Conductimetric measurements in sugar solutions at elevated temperatures. S. PERSSON. *Socker Handl.* II, 1964, **19**, 65–85.—Tests were carried out to determine whether a maximum conductivity of a sugar solution occurred at a given refractometric Brix at temperatures above 20°C. (At 20°C the conductivity is maximum at 28°Bx.) The results, given in graph and tabulated form, showed that at 20–85°C the conductivity-Brix relationship had a maximum value dependent on temperature. The relationship was approximately linear at 60–85°C but there was marked deviation from linearity at lower temperatures. On the basis of the results it is thought possible to design an automatic recorder which would measure the conductivity of a suitable diluted juice at its maximum and relate the measured value to a determined standard temperature by means of an electrical temperature compensation.

Beet molasses formation and composition. I. The solubility equation. G. VAVRINECZ. *Cukoripar*, 1965, **73**, 3–11.—See *I.S.J.*, 1965, **67**, 250.

* * *

Beet molasses formation and composition. II. Average composition and the melassigenic coefficients. G. VAVRINECZ. *Cukoripar*, 1963, **18**, 33–40.—The average composition of a "standard" molasses is derived from data in the literature. Since a considerable proportion of the organic non-sugars is in the form of various anions linked with cations, ash data give no indication of the quantity of salts present in molasses. Therefore, the terms "inorganic non-sugars" and "organic non-sugars" are replaced by "salts" and "non-salts" respectively. The probable composition of an average molasses is given as 18% water, 51% sucrose, 16% salts and 15% non-salts. The two last groups are broken down into their components. The corresponding non-sugars:water ratio is 1·722, the sucrose:water ratio (w/w) at 40°C is 2·833 and the Claassen saturation coefficient 1·208. The stoichiometric ratio sucrose:salts is dependent on the non-sugar:water ratio and hence on the sucrose content as governed by the water content. However, the composition of most sucrose-salt compounds and the effect of the salts on the optical rotation of the sucrose indicate the presence of associates with a ratio of 1 mole sucrose:1 valence salt, which agrees with the values of 1·0–1·1 obtained by various authors, including DĚDEK, WIKLUND and CAROLAN. Molar melassigenic coefficients obtained by SILIN[1] and KHVALKOVSKII[2] do not have the value of unity and in most cases are well below. Hence, the value of 1 for the sucrose:cation ratio is unexplained. The difference between highly and weakly melassigenic substances is not so pronounced in the tabulated values, KCl appearing as moderately instead of strongly melassigenic and K tyrosinate appearing as strongly instead of weakly melassigenic. Whereas, assuming melassigenesis to be additive, the resulting molar melassigenic coefficients of the salt combinations should remain unchanged when their corresponding ions are exchanged, in fact this is not so. This would seem to indicate that the coefficient is not additively influenced by the ions or individual non-sugars but is dependent on the quantities of the salts. However, it has been shown[3] that the effect of the salts on the optical rotation is proportional to the salt content. A number of questions remaining to be answered regarding the melassigenic coefficient are listed. While SILIN's coefficient is dependent on concentration and temperature, that of WAGNER-OWSKI[4] is constant and characteristic for the non-sugar mixture present and independent of concentration and temperature. From their equations an expression is derived relating the two coefficients.

* * *

Sugar quality determination is a relative problem. A. EMMERICH. *Ind. Sacc. Ital.*, 1965, **58**, 57–74. See SCHNEIDER *et al.*: *I.S.J.*, 1965, **67**, 91.

Sugar cane productivity equivalence factors. F. GOMEZ A. *La Ind. Azuc.*, 1965, **70**, 89–91.—Data for a number of cane varieties are used to indicate the preferability of a new factor for comparing the profitability of each. The factor TAHME (tons of sugar per hectare per month equivalent) is given by $\frac{TAHM \times Bs + M \times TCHM - C \times TCHM}{Bs}$, where *TAHM* is the sugar yield (tons of sugar per hectare per month), *Bs* and *M* are the net selling prices of sugar and molasses, respectively, TCHM is the cane yield (tons cane per hectare per month) and *C* is the cost of cane cutting, transport, etc. This new formula thus takes into account the extra cost of handling a larger tonnage of cane to obtain the same sugar yield and also the additional income from molasses produced.

* * *

Chemical composition of some molasses. N. K. PALAGINA, N. V. ROZMANOVA. A. I. KRYCHEVA, V. A. SOLOMAKHINA and Z. M. SAFRAI. *Khlebopekar. Konditer. Prom.*, 1965, **9**, (1), 23–26; through *S.I.A.*, 1965, **27**, Abs. 114.—Analyses of beet molasses from several regions of the U.S.S.R. (1961 and 1962 seasons) are tabulated and discussed from the point of view of yeast production. It is concluded that molasses from early in the campaign is preferable to that produced later. Since compositions are very variable, it is recommended to carry out routine analyses of pH, buffer capacity, foam persistence, Ca and Mg contents, and amino-N, in addition to the usual analyses.

* * *

Diagram of the heat content of technical sugar solutions and massecuites. YU. A. TERENT'EV and V. D. POPOV. *Izv. Vysshikh Ucheb. Zaved., Pishch. Tekhnol.*, 1964, (5), 127–130; through *S.I.A.*, 1965, **27**, Abs. 143.—A nomogram is presented for calculating the heat content, in kilojoules/kg of dry matter, of sugar solutions and massecuites of varying purity, supersaturation, temperature (60–120°C) and Brix (59–100°Bx).

* * *

Viscosity of water-alcohol and water-alcohol-sugar solutions as a function of their composition and temperature. S. E. KHARIN and A. A. KNIGA. *Izv. Vysshikh Ucheb. Zaved., Pishch. Tekhnol.*, 1964, (5), 135–139; through *S.I.A.*, 1965, **27**, Abs. 149.—It is demonstrated, on the basis of data for solutions containing 10–35% of sugar and 16–36% of ethanol at 0–40°C, that the ratio of the viscosities of the 3-component solution and of the corresponding water-alcohol solution is approximately a 3rd degree function of the sucrose concentration. Experimental data and calculated values are tabulated.

[1] *I.S.J.*, 1964, **66**, 255–258.
[2] *I.S.J.*, 1965, **67**, 90.
[3] VAVRINECZ: *I.S.J.*, 1962, **64**, 308.
[4] *I.S.J.*, 1961, **63**, 352.

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.

Cane mill headstocks. Fletcher & Stewart Ltd., Masson Works, Derby.

A small modification has been made to Fletcher & Stewart mill headstocks which simplifies the job of levelling them during erection. The base of each headstock will in future have 4 tapped holes (2 on each side) into which setscrews will be fitted before the headstock is stood in position on the mill foundations. Steel plates of a convenient size and thickness will need to be laid on the concrete to provide a bearing surface for the screw heads. It will be a relatively easy matter to raise or lower the headstock merely by turning the setscrews with a spanner. Wedges should be lightly driven in to take the load off the setscrews when correct alignment has been achieved, and these should be left in and grouted in position.

* * *

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

"Fabcon EVC" is an acid-based powdered chemical formulation developed for acid cleaning of sugar juice evaporators with minimum corrosion. While more expensive than the use of muriatic acid, the fact that it is less than one-tenth as corrosive as muriatic acid more than compensates for the additional cost.

With EVC, temperature should be maintained at approximately 160°F, since above 160°F performance decreases owing to deterioration of the cleaning solution. A concentration of 5% by weight is desirable. The advantages of higher concentration of solution can be used by washing the evaporator for the first half hour at a level of one-third up the calandria tubes. For the final hour of washing, additional water should be added up to the top level of the calandria tubes.

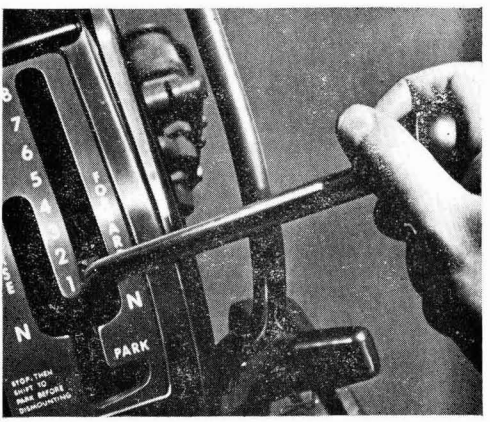
Turbulence increases cleaning effectiveness. Compressed air, mechanical mixing or the limited use of live steam all promote turbulence which enhances cleaning effectiveness. From 2·5 to 7·5 lb of EVC per 100 sq. ft. of evaporating surface is the range of EVC required for effective cleaning. The exact amount will depend on the practical cleaning cycle available and the severity of scaling.

* * *

Type 4020 tractor. John Deere (Lundell) G.B. Ltd., Edenbridge, Kent.

The large type 4020 tractor features a revolutionary system of transmission for this type of equipment, giving increased power and flexibility of operation. The tractor is powered by a 6-cylinder diesel engine of 106 h.p. and is fitted with power shift transmission, a system which provides eight forward and four reverse speeds. Any of these speeds can be selected by the driver when the tractor is in motion or when stationary.

The power shift transmission unit consists of three assemblies made up of two compound planetary gear sets, three clutches and four brakes. The first two clutches transmit engine power to the planetary gear assembly and the rear clutch to the power take-off gear train.



The selection of the various combinations of clutches and brakes needed to obtain the eight forward and four reverse speeds is effected by means of a single hand lever without the operation of a clutch pedal and without interruption of power to the drive wheels. Any speed can be engaged when the tractor is in motion, even under full load.

The direction reverser action is ideal for loading and stacking operations and for any kind of manoeuvre which requires a constant back and forth motion. Various other features incorporated in the 4020 tractor include power brakes (operated individually or together), power steering, hydraulic equipment control and power differential lock. This latter feature, by means of which the driver can lock the differential when ground conditions make traction better on one wheel than on the other, is hydraulically operated and can be engaged when stopped or when in motion even under heavy load. An inching pedal is provided for manoeuvring in difficult conditions, for backing up to implements and for emergency stops. It also acts as a safety device as it must be depressed when starting the engine.

* * *

New valve actuator. Saunders Valve Co. Ltd., Cwmbran, Monmouthshire.

The problem of operating valves automatically in remote and isolated areas—particularly where no mains power supply is available—has been overcome by a revolutionary new method of valve actuation

which is so versatile that it can be operated from a D.C. or A.C. source of any voltage, adjusted to a nominal D.C. voltage at the actuator. Thus an ordinary car battery can successfully be used.

The unit is compact and self-contained and there is no need for the ancillary equipment such as cumbersome compressors and other expensive units which are required in other methods of pressure actuation of valves. The valve actuation is based on the electrolytic principle. When current is passed through the electrolyte, hydrogen and oxygen gases are created causing a pressure build-up until the operating diaphragm opens. Safety devices incorporated in the system prevent further expansion once the valve is open. To close the valve, the gaseous mixture is ignited by means of a glow-plug. The hydrogen and oxygen then re-combine to form water and immediately the operating pressure disappears and the valve is closed.

Important features of the development are that the electrolyte does not require topping-up and there is no exhaust which means that there is no fire risk. The new actuator can be fitted to both diaphragm and ball plug types of valve.

* * *

Trist-Sauter humidistat. Ronald Trist Controls Ltd., Slough, Bucks.

The humidistat has a sensitive cotton element composed of a number of parallel spun-cotton threads mounted under tension. When the relative humidity of the ambient air increases, these threads dilate by absorbing moisture and the ensuing movement of the spring-opposed end of the sensing element is transmitted to the switch head via a mechanical linkage.

The Trist-Sauter HB series humidistat can be fitted with a choice of on/off or three-position electric contacts, or potentiometric or pneumatic outputs. It is constructed exclusively from non-corrosive materials and the non-ageing cotton element, which requires no regeneration, is impervious to dust and is independent of temperature fluctuations.

* * *

PUBLICATIONS RECEIVED

LUBRICATED JOINT ROLLER CHAIN. Link-Belt Company, Prudential Plaza, Chicago, Ill., 60601 U.S.A.

Folder 3043 describes a new self-lubricated power transmission chain which is designed for drives where external lubrication is difficult or impossible, such as in packaging machines.

"LJ" chain uses bushings made of oil-impregnated sintered powdered metal in place of conventional bushings and rollers. Operating heat causes the oil to flow out of the porous bushings and coat the chain's bearing surfaces. When the drive is idle, the bushings reabsorb and store the oil. The chains can operate at speeds up to 1,200 f.p.m. and in temperatures up to 120°F and are available in standard pitches of ½ in, ⅝ in and ¾ in, and double-pitch sizes of 1 in, 1¼ in and 1½ in.

QUELQUES RECENTES REALISATIONS (SOME RECENT ACHIEVEMENTS). Soc. Fives Lille-Cail, 7 rue Montalivet, Paris 8e, France.

This is the title of a 40-page publication containing numerous illustrations of the various types of plant manufactured by Fives Lille-Cail for different industries for over 150 years. The captions are in English, French and Spanish. The sugar industry is represented by photographs of the Béja beet factory in Tunisia, with a daily slice of 1500 metric tons of beet and an output of 350 metric tons of white sugar per day; a photograph of a model of the Orelka sugar factory in the Soviet Union, which has a daily slice of 5000 metric tons of beet (Fives Lille-Cail have also supplied two other factories of this capacity to the U.S.S.R., one at Otrada and the other at Nikiforovka); the Tababuela sugar factory in Ecuador, with a crushing capacity of 700 tons of cane/day, extendible to 1000 tons/day; and various pieces of sugar equipment, including the self-setting cane mill, horizontal vacuum pan, automatic centrifugal, RT diffuser, and continuous centrifugals built under licence from Hein, Lehmann & Co. A.G.

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O-RING SEAL TYPE FLOWMETERS. Brooks Instrument N.V., Veenendaal, Holland.

Specification sheet DS-1112A gives details of the Brooks "Full-View" O-ring seal type flowmeter. This pipeline-mounted instrument is made of stainless steel with a borosilicate glass metering tube and is available in six sizes providing 30 different flow ranges with maximum flow rates from 643 c.c./min to 98·60 g.p.m. of water (or gas equivalent). The nominal scale length is 250 mm. The O-ring seals offer an advantage over packed gland type meters in that the tube and float can be easily removed and replaced without disassembling the meter case.

* * *

Siemens turbo-generator sets for Portuguese East Africa.—Siemens Schuckertwerke are to supply two turbo-sets for the new Manhiça sugar factory at Maragra, Portuguese East Africa. The extraction-condensing sets are each rated at 4000 kW at 11 kV. The contract was placed by Messrs. James Brown and Hamer, of Durban, South Africa, who are the general contractors responsible for the overall project.

* * *

Scandinavian representation for filter media.—Arrangements have been concluded between Multi-Metal Wire Cloth Inc., of Tappan, N.Y., U.S.A., and Ingenjorsfirman Teko AB. of Stockholm, Sweden, giving them exclusive representation of "Neva-Clog" filter media and "Mer-Made" plastic filter leaves in the countries of Denmark, Norway, Sweden and Finland.

* * *

Fletcher and Stewart mills for Argentina.—A large order, worth approximately £280,000, has just been booked by Fletcher & Stewart Ltd. for the Rio Grande sugar factory in Jujuy Province. The order covers the supply of a complete new milling plant for the factory. Cane carrier, cane knife sets and 4 three-roller 36 × 72 in mill units driven by individual steam turbines through double reduction gear units comprise the main items. The intermediate carriers will be of the scraper type and the plant will be capable of crushing 3400 tons of sugar cane per day. It will be in operation late in 1966.

* * *

Silver diffuser licence.—Fletcher and Stewart Ltd. have signed an agreement with American Factors Associates Ltd., giving them the exclusive right to manufacture, sell and use the Silver system and process for cane diffusion in Great Britain, British West Indies, British Guiana, Bahama Islands and British Virgin Islands and an accompanying non-exclusive right to sell and use the system in all countries of the world except Brazil, Canada, France, Germany, Japan, Holland and the United States, its territories and possessions.

BREVITIES

U.S.S.R. sugar industry[1].—According to an announcement made during a session of the Economic Council of the Soviet Union, 299 sugar factories will be in operation during the 1965/66 crop, thirteen of them being new plants.

* * *

Increase in U.K. sugar surcharge.—The Sugar Board surcharge of 3½d per lb (32s 8d per cwt) was increased to 3¾d per lb (35s 0d per cwt) from the 27th August 1965. The change in surcharge, which resulted in an increase of about 2s 4d per cwt in the ex-refinery price, was made to bring the Sugar Board's trading position more into line with the current level of world raw sugar price. The previous change in surcharge was a reduction of 2s 4d per cwt on the 4th May 1965.

* * *

French beet area[2].—Concern has been expressed by the French Beet Growers' Association at the low return being received by beet farmers and it is seeking an increase in the price of sugar in France to a level more in conformity with values prevailing elsewhere in the E.E.C. On 1st September it recommended a reduction of 22% in the French beet area in 1966 in order to avoid having to dispose of large quantities of sugar to foreign countries at a price well below the cost of production, while subsequently cuts of at least 35% have been advanced[3].

* * *

British Guiana sugar industry plans[4].—The British Guiana Government plans to stimulate peasant sugar cane farming as part of an organized industry. District associations of cane farmers are to be set up to make representations and recommendations to a national committee, which will fix prices to be paid to the farmers for cane sold to the sugar factories. Represented on the committee will be the farmers, the Sugar Producers' Association, the Government and a development corporation which is to be established soon.

European Sugar Beet Area Estimates[5]

	hectares			
	1965/66		1964/65	1963/64
Western Europe	*2nd Est.*	*1st Est.*		
Western Germany ..	296,791	295,000	330,231	303,081
Austria	39,000	48,000	52,600	48,225
Belgium/Luxembourg	62,000	[67,000	64,000	57,000
Denmark	56,000	56,000	69,900	57,700
Finland	19,000	20,000	18,919	17,038
France	365,789	360,000	387,212	338,548
Greece	16,051	16,300	12,627	9,300
Holland	91,815	95,000	79,134	69,513
Ireland	26,900	26,900	32,079	35,604
Italy	255,000	245,000	222,905	221,485
Spain	160,000	175,000	140,000	110,000
Sweden	43,000	43,000	44,072	40,380
Switzerland	8,500	8,550	7,578	6,916
Turkey	160,690	180,000	188,215	136,634
U.K.	178,000	178,000	172,970	165,303
Yugoslavia	80,000	80,000	88,000	95,000
Total	1,858,536	1,893,750	1,910,442	1,711,727
Eastern Europe				
Albania	6,000	6,000	5,500	5,500
Bulgaria	75,000	75,000	70,000	68,800
Czechoslovakia	230,000	252,000	257,000	283,000
Eastern Germany....	230,000	235,000	235,000	232,152
Hungary	122,600	122,600	133,257	118,160
Poland	470,000	475,000	445,000	371,000
Roumania	190,000	195,000	189,100	178,500
U.S.S.R.	4,200,000	4,200,000	4,200,000	3,300,000
Total	5,523,600	5,560,600	5,534,857	4,557,112
Total Europe	7,382,136	7,454,350	7,445,299	6,268,839

U.K. Sugar Board's accounts.—The Minister of Agriculture, Fisheries and Food has made an order providing that the annual accounting date of the Sugar Board shall be altered from 30th June to the 31st December. The Board's next accounting period will accordingly be the eighteen months to 31st December 1965, and the Board's Report and Accounts to that date are expected to be published in March 1966. This change follows on the alteration of the annual accounting date of the British Sugar Corporation Ltd. from 31st March to the 30th September, and is intended to preserve the same time relationship between the accounting periods of the two organizations. The Sugar Board have informed the Minister that they have recovered the cumulative deficit of £18,750,000 outstanding on their revenue account as at 30th June 1964.

* * *

Puerto Rico sugar quota deficit[6].—On the 13th August, the U.S. Dept. of Agriculture declared a deficit of 200,000 short tons, raw value, in the sugar quota for Puerto Rico and on the 1st September allocated 64,412 tons to the Philippines and most of the remainder to Western Hemisphere countries as indicated below. Special consideration was given to those countries offering to purchase and import U.S. agricultural commodities before 1st July 1965. A quantity of 31,769 tons has been withheld from the Dominican Republic pending resumption of diplomatic relations with the U.S.A.

Country	*Quantity of sugar allocated (short tons, raw value)*
Brazil	18,228
British Honduras	346
British West Indies	10,061
Colombia	2,314
Costa Rica	2,875
Ecuador	4,077
El Salvador	1,428
French West Indies	3,537
Guatemala	2,893
Haiti	1,530
Mexico	32,160
Nicaragua	3,346
Panama	1,195
Peru	19,829
Total	103,819

* * *

U.S. Sugar Act proposals.—The U.S. Secretary of Agriculture sent to Congress on the 17th August proposals by the Administration for a new Sugar Act to extend to 1971. The Bills presented to both houses have since been under discussion by the respective Agriculture Committees. They propose that on the basis of a national consumption level of 9,700,000 tons, the domestic beet share should be raised by 375,000 tons to 3,025,000 tons and the mainland cane share by 205,000 tons to 1,100,000. Up to a total requirement of 10,400,000 tons they would receive no further increase, but beyond this level would share 65% of the higher demand. For Hawaii, Puerto Rico and the Virgin Islands the same provisions are proposed as in the current Act, while the Philippines would have a permanent quota of 1,050,000 tons and 10·86% of market growth getween 9,700,000 and 10,400,000 tons. Foreign suppliers, it is proposed, would receive a basic quota, expressed as a percentage of a total foreign quota, and a proportion of a Cuban reserve quota which totals 57·77% of foreign supplies. Imports exceeding current levels would be allocated principally to developing countries and, to encourage countries to maintain reserve stocks for the U.S., quotas of countries failing unjustifiably to supply their quotas would be permanently reduced. The recommendations also provide for elimination of the import fee on sugar which was part of earlier U.S. sugar legislation.

[1] F. O. Licht, *International Sugar Rpt.*, 1965, **97**, (21), 15.
[2] C. Czarnikow Ltd., *Sugar Review*, 1965, (728), 153.
[3] *Public Ledger*, 18th September 1965.
[4] *The Times*, 31st August 1965.
[5] F. O. Licht, *International Sugat Rpt.*, 1965, **97**, (21), 1.
[6] Lamborn, 1965, **43**, 129, 145.

U.K. National Sugar Beet Autumn Demonstration, 1965.—Machines from two companies new to sugar beet harvesting will appear in the entry of nearly twenty harvesters to be operated at the national sugar beet autumn demonstration to be held on 21st October at the farm of C. A. West & Son Ltd. at Brome, near Eye, Suffolk, where the spring demonstration was also held this year. The harvesters will operate on hand-singled and mechanically thinned sections of crop. Cleaner-loaders, specialized trailers and reversible ploughs will also be demonstrated, while a large static display of spring mechanization equipment will be included. The demonstration is held under the auspices of the Sugar Beet Research and Education Committee of the Ministry of Agriculture, Fisheries & Food and is organized by the British Sugar Corporation and National Agricultural Advisory Service.

* * *

World raw sugar price.—The U.K. Terminal or "London daily" price of sugar rose to £20 10s a ton on the 20th September, its highest level since the 6th August. At the beginning of the month the price had fallen to its lowest absolute level of £17 15s and had fluctuated since then with an upward trend. It was coincidence that the rise occurred on the day when the U.N. Sugar Conference started in Geneva, and it is partly due to the political tension in Asia arising from the Indian-Pakistan conflict. But, more important, most of the second-hand Brazilian raw sugar hanging over the market for some time has now been absorbed by consuming countries and this has been reflected in better prices paid for first-hand raws.

West Germany sugar imports[1]

Source:	1964	1963	1962
	(metric tons, raw value)		
Belgium/Luxembourg	7,552	10,917	5,195
Brazil	2,903	0	0
Canada	0	5,314	0
Cuba	0	1,342	52,245
Czechoslovakia	8,606	20,475	13,004
Denmark	397	1,431	61
Dominican Republic	2,239	2,688	8,624
France	36,532	87,514	38,228
Germany, East*	28,907	27,054	39,856
Hungary	372	6,488	228
Italy	0	10,872	0
Malagasy Republic	0	2,184	0
Mexico	806	0	0
Netherlands	1,512	2,433	1,882
Peru	2,357	988	10
Poland	127	35,162	9,732
Réunion	0	1,245	0
Russia	632	37,133	3,499
Surinam	133	986	0
United Kingdom.....	381	81,667	29,107
Other Countries	510	33	9
Total	93,966	335,836	201,680

* Includes from East Germany to West Berlin: 1962, 28,602 tons; 1963, 21,602 tons; 1964, 17,949 tons.

Stock Exchange Quotations

CLOSING MIDDLE	
London Stocks (*at 17th September* 1965)	s d
Anglo-Ceylon (5s)	5/–
Antigua Sugar Factory (£1)	11/–
Booker Bros. (10s)	19/3
British Sugar Corp. Ltd. (£1)	19/4½
Caroni Ord. (2s)	2/4½
Caroni 6% Cum. Pref. (£1)	16/3
Demerara Co. (Holdings) Ltd.	3/6
Distillers Co. Ltd. (10s units)	25/6
Gledhow Chaka's Kraal (R1)	18/–
Hulett & Sons (R1)	17/6
Jamaica Sugar Estates Ltd. (5s units) ..	3/6
Leach's Argentine (10s units)	14/–
Manbré & Garton Ltd. (10s)	28/3
Reynolds Bros. (R1)	18/–
St. Kitts (London) Ltd. (£1)	12/3
Sena Sugar Estates Ltd. (5s)	8/3
Tate & Lyle Ltd. (£1)	29/9
Trinidad Sugar (5s stock units)	2/11¼
West Indies Sugar Co. Ltd. (£1)	8/9

CLOSING MIDDLE	
New York Stocks (*at 16th September* 1965)	$
American Crystal ($5)	18⅛
Amer. Sugar Ref. Co. ($12.50)	25
Central Aguirre ($5)	29⅞
Great Western Sugar Co.	39⅛
North American Ind. ($10)	14
South P.R. Sugar Co.	22½
United Fruit Co.	23½

By-products research in the Philippines[2].—The Philippine Sugar Institute is to set up an industrial research laboratory in Diliman, Quezon City, to conduct studies on the utilization of sugar by-products. The new laboratory will complement the work of the other laboratories and experimental stations in the Visayas, the Batangas laboratory and the new 260-ha sugar experimental station in Floridablanca, Pampanga.

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New Guinea sugar industry[3].—A programme of field experiments by the Dept. of Agriculture, Stock & Fisheries to test the prospects for development of a sugar industry has begun, according to the Australian Minister for Territories. A recent study showed that the Markham Valley and Brown River areas of New Guinea may have potential as sugar growing areas. An industry would save funds now used for importing refined sugar from Australia and would also provide employment. But precise knowledge about sugar yields and sugar content of cane would be needed before investment in a modern mill would be warranted.

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Hurricane damage in Louisiana.—Louisiana suffered extensive damage to its crops when struck by hurricane "Betsy". The Farmers' Home Administration reported that the entire cane crop had been twisted and was on the ground. The Louisiana State Commission of Agriculture said that 20% of the crop had been lost.

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Furfural plant possibility for Florida[4].—The Sugar Cane Growers Cooperative of Florida has met to hear a report on by-product utilization studies carried out for the Cooperative during the past two years and to consider a possible agreement with Quaker Oats Co. for erection of a plant for the production of furfural. Final decisions were delayed until additional information is received and discussed.

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Trinidad 1964/65 sugar crop[5].—The 1964/65 sugar crop amounted to a record level of 250,892 tons, compared with 226,531 tons in 1963/64.

[1] *Lamborn*, 1965, **43**, 107.
[2] *Sugar y Azúcar*, 1965, **60**, (9), 74.
[3] *Producers' Review*, 1965, **55**, (7), 84.
[4] *Sugar y Azúcar*, 1965, **60**, (9), 66.
[5] *Fortnightly Review* (Bank of London & S. America Ltd.), 1965, **30**, 766.