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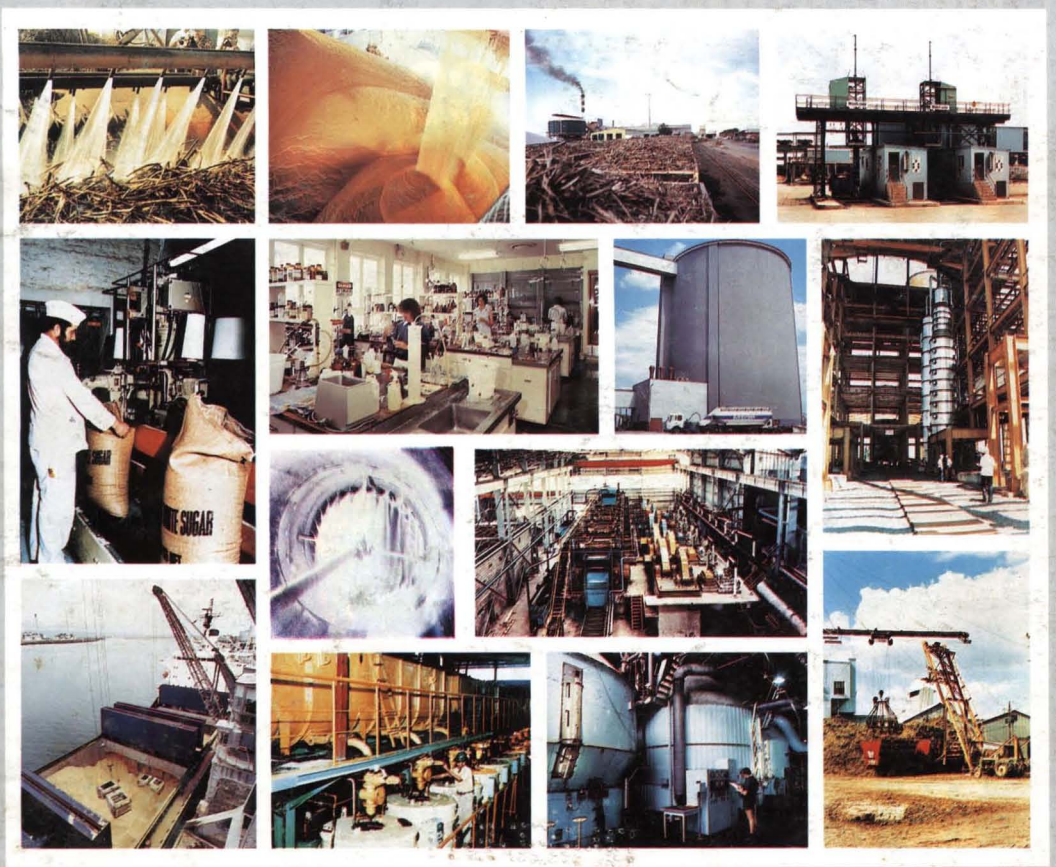

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CONTENTS

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News and views

Cloud over Brazil's alcohol industry

Brazil is reported to have discovered a massive new oil field in the mouth of the River Amazon[1]. Some reports put it at about the size of the combined North Sea fields which, if confirmed, will raise the country's reserves from some 2500 to 22,000 million barrels and make the country the second richest in terms of oil in Latin America after Mexico.

Established against a background of uncertainty in oil supplies and the need to conserve foreign currency while providing additional domestic employment, the Brazilian fuel alcohol industry has been so successful that it now absorbs some 70% of all sugar cane grown in the country. However, its success has been built on a preferential fiscal system and on June 22, the government reduced the subsidy to consumers of fuel alcohol, raising the price from 65 to 69% of that of petrol[2]. This is not expected to cut the demand for alcohol fuel at the pumps but it may increase the proportion of petrol-fuelled cars made. However, any further adjustment in the subsidy might undercut the economic viability of the fuel alcohol program.

The June action is not expected to affect the proportion of cane used for alcohol manufacture; however, if owing to the new oil discovery there was a slackening in demand for alcohol, it must be presumed that there would be a redirection of cane to the sugar factories. When it is remembered that Brazil's present sugar production is derived from only 30% of the cane grown in the country, the potential effect on the world market of such a redirection is obvious. Developments will no doubt be watched closely to see whether a change in the pattern of cane deliveries develops.

UN conference on sugar industry diversification

The first inter-regional consultation on the food processing industry with emphasis on sugar cane processing to be convened by the United Nations Industrial Development Organization (UNIDO), was to be hosted by the Cuban government and held in Havana during September 26 - 30. The provisional agenda is in two parts, the first concerning diversification of the cane sugar industry and covering by-product utilization and improvements in the utilization of sugar as well as financing, international cooperation, etc. The second part was to be concerned with improvement in productivity, in respect of reducing production costs, increasing yields, rational energy utilization, etc. Interested readers should seek information from UNIDO, Consultations System Division, P.O. Box 300, A-1400 Vienna, Austria.

Patterns of sugar production increase

F. O. Licht GmbH have recently drawn attention[3] to the difference in the way production and consumption have increased among economic groupings over the past eight years. In the developed countries as a whole, production has risen from 37,880,000 tonnes, raw value, in 1980/81 to 43,600,000 tonnes in 1987/88, corresponding to an average annual increase of 2.0%. The rise among the developing countries has been from 50,847,000 to 61,373,000 tonnes, or 2.7% per annum.

For those countries which are importers the rise has been from 36,116,000 to 50,043,000 tonnes, equivalent to an annual increase of 4.8%. By contrast the rise in the exporting countries has been from 52,611,000 tonnes to 54,929,000 tonnes, or only 0.6% per annum.

Consumption increase in developed countries has been at an even smaller rate of 0.3%, growing from 46,419,000 to 47,471,000 tonnes, while that in the developing countries has been from 43,384,000 to 58,431,000 tonnes, or an annual average of 4.4%. Among importers the increase has been from 60,797,000 to 72,953,000 tonnes, i.e. 2.6% per annum, and among exporters from 29,006,000 to 32,948,000 tonnes, or 1.8%.

This shows that gains in production have been strongest in importing countries, reflecting a drive for import substitution in developing countries and protectionist sugar policies in the large industrialized sugar importing states. The 0.6% rise in the production of sugar exporting countries is very modest and reflects the loss of their markets while, although the annual increase has been greater in developing countries than in the developed world, it represents less than their consumption increase (2.7% *vs.* 4.4%) whereas the smaller rise in developed countries is nevertheless larger than required to meet consumption increase (2.0% *vs.* 0.3%).

Licht comments that, unless there is a major turnaround in agricultural protectionism, the world market for sugar will become a negligible quantity.

Sugar market prospects for 1988/89

In a first assessment of prospects for the sugar market during 1988/89, Sucden Kerry International[4] note that, of the major exporters, the EEC expects a 1% reduction in beet area; no major change is expected in South Africa and Australia; absence of drought effects and the shift from alcohol may result in more sugar being produced in Brazil; Cuba's crop is unlikely to improve markedly and may well have been harmed by recent floods; but in Thailand price increases may encourage further production.

Of the major importing countries, China has taken measures to expand domestic production but these are thought too little and too late to regain previous levels. The excellent climatic conditions of last season are not likely to prevail in the USSR and 1988/89 sugar production may be reduced; a similar outlook is expressed for India where high cane prices have led to small

1 F. O. Licht, *Int. Sugar Rpt.*, 1988, **120**, 316 - 317.
2 *Financial Times*, June 24, 1988.
3 *Int. Sugar Rpt.*, 1988, **120**, 288 - 289.
4 *Sucden Kerry International Annual Review*, June 28, 1988.

margins for producers. No increase is expected in US sugar production; in fact, if the drought presently affecting the beet crop continues, there might be sugar losses of unknown magnitude.

Initial indications are therefore for a world production in the region of 104 - 106 million tonnes against an estimated consumption of 105.3 million tonnes. It is thus not possible to say whether there will be a further draw-down of stocks. How much sugar will be available for export from Brazil is the main question mark affecting the market while, so far as demand is concerned, the key element is the USSR. Cuba will have to reserve a substantial part of its production to replace sugar bought on the free market in 1987/88. If this reduces supplies to the Soviet Union and domestic production in that country is lower than last campaign, it could regain its position as the world's largest importer and restore the world market to a deficit statistical situation.

Brazil sugar production plan, 1988/89

The Brazilian Sugar and Alcohol Institute has recently released its plan figures for the North-Northeast region; the corresponding figures for the Centre-South region were released some weeks earlier. The plan calls for a total of 8,370,000 tonnes, tel quel, of sugar to be produced, against 7,922,000 tonnes in 1987/88 (when actual production totalled 7,985,000 tonnes). Planned alcohol production is 12,751 million litres or more than 10% over the 11,459 million litres made during the 1987/88 plan period.

Australia complaint to GATT over the US sugar program[5]

Australian trade officials are to file a formal complaint against the USA sugar program under the General Agreement on Tariffs and Trade (GATT). Australia will request that a panel be established under GATT Section 23 to investigate its complaints about the sugar import quota. Australian officials were not satisfied during talks with their US counterparts to explain the legal basis of the program under the GATT.

However, the Australian sugar industry doubts the worth of any GATT action against the United States; the system has been in existence for some years and GATT would not be able to enforce any decision it reached. Continuation of US barriers against imports would, however, be unfair when Australia has stated its intention to end its ban on imports next year. According to the Sugar Board chairman, Australia can only force the US to liberalize its sugar markets by constant pressure, and its decision to seek GATT help is part of this strategy.

EEC sugar export prospects[6]

The crops in most countries of the EEC are considered by C. Czarnikow Ltd. to be looking attractive and are expected to yield better than average returns. They consequently forecast an output of almost 13,750,000 tonnes, white value. To this must be added 1,100,000 tonnes of minimum and free stocks and 1,273,000 tonnes of blocked stocks from 1987/88, 1,380,000 tonnes of imports from the ACP countries, 142,000 tonnes of non-ACP imports into Portugal and 44,000 tonnes from East Germany and others. This gives a total availability of 17,689,000 tonnes to meet consumption of 11,050,000 tonnes and 150,000 tonnes of net exports in goods. Minimum and free stocks required for 1989 are set the same as for the present year, i.e. 1,100,000 tonnes, giving a maximum excess of 5,389,000 tonnes.

Of this the indicated quota surplus is 2,902,000 tonnes, while C-sugar out of quota is 2,487,000 tonnes. While the former is under the direct control of the EEC authorities, the latter is entirely the responsibility of producers and their decisions about how much of this sugar they will set aside for one year will be one of the important market variables for the first half of 1989. Over the past several seasons world prices have been low and producers have elected to carry forward as much as 50% of their C-sugar production as blocked stocks. Although world prices have risen rapidly over the past few months, the return in national currencies may even now not yet represent a strong inducement to maximize exports.

Much will depend on price expectations which present themselves next January when most producers have to declare their options. Benefits of holding stocks which will gain the full internal support price after a year must be weighed against the likelihood of such declarations locking sugar out of what may be the best world market return for many years. Over the next few months producers of C-sugar will be reassessing the effects on their sales strategy of varying levels of world market price and there can be no safe assumptions about the likely split between set-aside and world market sales volumes.

UK sugar refining margin

An agreed revision to the UK cane sugar refining margin, announced by the UK Ministry of Agriculture, Fisheries and Food on July 20, will improve Tate & Lyle's earnings in the UK. Although margins per tonne are still much larger on beet processing than cane raws refining, the changes reduce the disparity. With EEC agreement, the British government will grant aid to the UK refiners of 75% of 5 ecu (£3.28) per tonne for the two years to June 30, 1989; the EEC will pay the balance of 25%. Refiners are to be compensated for the non-introduction of certain import facilities by an aid of 0.08 ecu (£0.52) per tonne, while the Commission is empowered to propose adjustments to the cane sugar refining margin in the event that it is affected by changes in the beet storage levy.

The announcement follows agreement by the Council of Ministers to the proposal by the Commission[7] for aid to be given to Community refiners, which largely means Tate & Lyle.

5 F. O. Licht, *Int. Sugar Rpt.*, 1988, **120**, 390.
6 *Czarnikow Sugar Review*, 1988, (1775), 100 - 101.
7 *I.S.J.*, 1988, **90**, 98.

Activities of GEPLACEA in the area of sugar technology

By Antonio Celso Sturion*

GEPLACEA – the Group of Latin American and Caribbean Sugar Exporting Countries – is a regional organization formed by 22 countries of Latin America and the Caribbean, which was constituted at Cozumel, Mexico, in November 1974.

GEPLACEA, in addition to being the most important group of cane sugar producing countries in the world, is an organ of consultation, coordination and information for the member countries on common questions relative to the production and marketing of sugar, as well as contributing to the creation of suitable means for instituting cooperation and integration, and promoting the harmonious development of the sugar industry of the member countries.

For its functioning, GEPLACEA has as permanent bodies its Assembly and Secretariat. The Assembly, the supreme organ of the Group, is made up of representatives of all the member countries and meets once a year. The Secretariat, the executive organ of the Group, which functions in permanent form, has its seat in Mexico City and comprises the Executive Secretary, the Deputy Executive Secretary, the Assistant Secretary on Marketing, the Assistant Secretary on Technology and technical and administrative staff.

Among the objectives and functions of GEPLACEA are those related to the technological aspects of the sugar cane agro-industry, namely:

– interchange of scientific and technological knowledge in matters of field, factory and sugar cane by-products utilization, and

– analysis of the possibilities for industrial advance in all the spheres of activity of the sugar industry.

GEPLACEA acts through a series of programs intended to meet the objectives of the Group, and those relative to technology are as follows:

– Cane Agriculture,

– Industrial Efficiency,

– Derivatives and By-products, and

– Cooperation on Energy.

The Cane Agriculture Program has as its general objective the search for increasing productivity in the cane fields of the member countries of the Group, by making more efficient the tasks involved in sugar cane agriculture.

In this program it is intended to put special emphasis on those aspects susceptible to coordination in areas of common concern for our countries and to seek, principally by means of horizontal technical cooperation, the solution of specific problems which are required in particular areas or countries.

To achieve these general objectives, the following activities are currently being developed:

– exchange of commercial and integral varieties,

– formation of a regional quarantine bank and of two regional banks of commercial varieties,

– direct consultation for the member countries on aspects related to cane agriculture.

In addition to these activities, GEPLACEA cooperates in the financing of the participation by cane technologists from member countries in international and regional events, as well as in the carrying out of various activities for diffusion and transfer of technology, such as the production of publications, making of videos and organization of conferences, seminars and workshops on cane agriculture.

In the Industrial Efficiency Program, the Regional Project for Maintenance and Repairs of the Sugar Industry of Latin America and the Caribbean has been developed with the cooperation of the United Nations Development Program (UNDP) and the United Nations Industrial Development Organization (UNIDO). This project is proposed for the reduction of costs by the application of modern techniques in repair and preventive maintenance, achieving in these activities a greater efficiency. To this end, in this field are carried out training courses, seminars, practical demonstrations and direct technical assistance, as well as the production of 10 specific publications on the theme.

In the same way, in the framework of the Industrial Efficiency Program, work is being done on the unification of methods of analysis used in the sugar cane agro-industry of the region. For this have been published the following: El Manual Unificado de Técnicas Analíticas de Azúcar y Mieles para América Latina y el Caribe (the Unified Manual of Analytical Techniques for Sugar and Molasses for Latin America and the Caribbean) in Spanish; El Manual para Analistas de Laboratorio Azucarero - Químico de Banco (Manual for Sugar Laboratory Analysts - Bench Chemist) in Spanish; and the Manual of Chemical Analysis of Ethanol in English and Spanish.

As part of the Derivatives and By-products Program is being developed, with the financial support of the UNDP, the Project for Diversification of the Sugar Industry of Latin America and the Caribbean, which has as its prime objective promotion of the development of the sugar agro-industry and is oriented towards the concept of industrial sugar derivatives integration. More than a response to the crisis of the cane agro-industry, this is conceived to be a viable initiative for the integral development of the regional sugar sector in the framework of industrial reconversion.

The Project is intended to create an infrastructure for the promotion of methods and systems of technical cooperation and interchange of scientific and technical knowledge on diversification, through the diffusion of the results of experience in member countries. In this context, priority is given to carrying out studies of diversification projects and the direct technical assistance for their implementation in the member countries.

The results of the Project should be reflected in the following aspects:

– A reduction of the vulnerability of the sugar agro-industry to the international market situation;

– Greater economic efficiency in cost-benefit terms;

– Greater energy and technological efficiency;

* Assistant Secretary on Technology of GEPLACEA.

– Broadening of technical cooperation and technological transfer between member countries;

– Increase of prospects for the creation of an intra-regional market for derivatives;

– Import substitution and creation of exportable surpluses which will generate an additional source of income, etc.

As well as the organization of seminars, conferences and direct technical assistance to member countries, 11 specific publications have been produced on different aspects of diversification of the sugar agro-industry.

Also, under the program of this Project, the following activities are planned for the near future:

– the creation of a system of information and interchange of experience;

– the preparation of an International Directory of Manufacturers, Users and Distributors of Derivatives and the principal competitive or similar products;

– the final production and publication of the Economic and Sugar Profiles of member countries; and

– the organization of different events on biotechnology – environmental contamination and diversification, as well as the corresponding *Proceedings*.

The Energy Cooperation Program, also framed within the activities of the Assistant Secretary on Technology, is intended to carry out applied research on the knowledge and integral development of the energy potential of sugar cane and to spread this among the member countries of the Group.

The production of alcohol as fuel and for other uses is considered within the Energy Cooperation Program. With the collaboration of other regional organizations, this looks after the development and application of efficient fermentation techniques, distillation and production of alcohol for various purposes, and the analysis of conditions existing in the member countries which intend to emulate the cases of Argentina, Brazil and El Salvador in the use of alcohol as a fuel.

The energy rationalization of sugar factories, also in the framework of the Energy Cooperation Program and with the collaboration of other regional organizations, is occupied with the use and rational generation of energy in the sugar agro-industry, through the efficient utilization of bagasse as a fuel, which permits the generation of surplus electricity for use in the national electrical grid or in other industrial enterprises, as well as a possible saving of bagasse for its use in the derivatives industry (board, furfural, pulp and paper, etc.).

From the above it will be seen that, while the activity of GEPLACEA in fields related to the international marketing of sugar continues to be one of the principal objectives of the Group, it currently seeks to direct its actions in such a way that subjects related to technology for the sugar cane agro-industry play a prominent part among the objectives of GEPLACEA and its functions, together with the member countries.

Argentina sugar technologists conference

The 5th meeting of the Argentina Society of Sugar Cane Technologists (SATCA) took place during late April at the Hotel El Jardín in the city of San Miguel de Tucumán. Delegates were welcomed by Sr. J. M. Hinojo, President of the Society and the conference was opened officially by H.E. the Provincial Governor. The opening ceremony was continued with presentations on the impact of fuel alcohol on health and the environment by a representative of the US Environmental Protection Agency, the present status of the sugar market by Dr. J. A. Cerro, Executive Secretary of GEPLACEA, and an account of the present policies for the 1988 crop in Argentina by Sr. R. Entrena. Agricultural and industrial technical sessions were then held separately apart from a joint meeting to hear Dr. James E. Irvine discuss "Biotechnology in the sugar industry".

The first agricultural session commenced with a panel discussion on rust disease, led by Drs. W. M. da Silva and H. Tokeshi of Brazil and Jorge A. Mariotti and Nilda Ramallo of the Bishop Colombres Experiment Station in Tucumán. There followed a paper by Dr. da Silva on the epidemiology of culmicolous smut disease of sugar cane and a survey of technological advances in mechanized harvest and transport, by Dr. A. L. Fors of the USA. A second panel discussion, led by Sr. Hinojo and Messrs. E. Pérez, M. van Balem and J. M. García Gonzalez, discussed productivity in the sugar cane industry, after which Dr. Y. Masuda spoke on the improvement of sugar cane.

In the industrial session papers were presented on the use of bagasse as a raw material for newsprint manufacture (by Dr. E. Fiallo), and the production of aldehydes from naphtha and alconaphtha (by Dr. C. Gotelli). Dr. Herly Noa of GEPLACEA presented a paper on industrial diversification while Dr. S. Moreno gave a detailed discussion on microbiological optimization of the sugar industry, after which Sr. Fernando Cordovez described the use of continuous vacuum pans.

The industrial program continued on the second day of the meeting with papers on modern technologies in heat exchange by Sr. M. Buela and one on mill rollers by Sr. J. Fariñas, while Sr. Cordovez concluded the session with a paper on bagasse board manufacture in Venezuela.

The agricultural section of the Society held a panel session on the second day which discussed a number of factors influencing sugar cane productivity. Dr. Irvine discussed the sugar cane plant, Dr. Fors discussed cane mechanization, Dr. A. Celso Sturion of GEPLACEA surveyed the position in Latin America and Dr. M. Tullio of

continued on page 181

Changes in US sugar purchasing arrangements

By Rodney Goodwin

There is no doubt that if it is wished to do so the USA could easily become self-sufficient in sweeteners. Indeed, the pattern established in recent years led to fears at one time that, by the end of the present decade, this might well be the case and imports of foreign sugar would become a thing of the past. Fortunately for the overseas suppliers all the indications are that next year will see a pick-up in import needs; for all that, the suppliers have every right to feel aggrieved at the treatment they have received in recent years and particularly since the beginning of the 1980's.

For many years supplies of sugar to the USA were carefully controlled by the operation of a quota system which applied both to domestic and foreign producers. For most of the latter the US market became a major outlet only from 1960. Prior to that time Philippines received a regular fixed quota of 980,000 short tons, in terms of raw value, whereas all other import needs were divided between Cuba on the one hand and all other foreign suppliers on the other hand with supplies from Cuba comprising more than 90% of the total. The actual tonnage to be supplied each year varied according to assessments of domestic needs while allocations of quota shortfalls also led to changes in entitlement. Although Cuba's dominant position as a supplier was actually diminished during the 1950's, being reduced in 1953 from 98.64% of all sugar originating from foreign countries other than the Philippines to 96.0% and again from 1957 to 93.75%, it was still by far the major supplier at the beginning of 1959 when revolutionary forces under Fidel Castro achieved power in the island.

It did not take long before major differences emerged between the governments of Cuba and the United States. Cuba's land reform program, which included some nationalization of US property, caused considerable concern in the USA and when this was followed, early in 1960, by a series of sales to members of the socialist bloc further imports of Cuban sugar into the USA were banned. In fact, though this took place in July 1960 and Cuba's supply quota for the year was in excess of 3.1 million short tons, only about 700,000 tons was excluded that year as the move had been widely anticipated. However, since that date no further Cuban sugar has been permitted entry into the USA.

Replacements needed for Cuban sugar

The removal of this major supplier means the USA had to look for replacements. The Philippines was already an important supplier and was able to step up its deliveries, but no other country had a quota even as large as 100,000 tons. Some were prepared to divert supplies from other destinations to the more remunerative US market while others stepped up output. Some producers which had not figured previously as suppliers to the US also began making regular deliveries.

The dominant position of Cuba as a foreign supplier to the US market prior to the banning of her sugar can be seen from the final US supply quotas for 1959, the year before the ban became operative, which were as shown in Table I:

Table I

	Short tons, raw value
Domestic beet	2,267,665
Mainland cane	697,783
Hawaii	977,970
Puerto Rico	969,875
Virgin Islands	12,405
Philippines	980,000
Cuba	3,215,457
* Full-duty countries	278,845
	9,400,000
* of which	
Peru	95,527
Dominican Republic	81,457
Mexico	64,809
Nicaragua	14,027
Haiti	7,014
Other countries	16,011
	278,845

By 1963 the number of suppliers delivering more than100,000 tons had risen to ten with a far more comprehensive list of origins than had formerly been the case. Considerable pressure was also developing from US producers to be permitted to expand the quantity they could supply to the domestic market and 1964 saw the first deliberate reduction made to the supply entitlements of overseas countries to enable domestic cane and beet producers to enjoy a greater share.

This was probably a realistic recognition of the fact that most of the domestic producers were just as capable of expanding their output to replace Cuban supplies as were the foreign producers, though over the years the importance of Puerto Rico as a sugar producer rapidly declined.

No complaints were voiced by the foreign suppliers at this time and despite the increased supplies from domestic origins requirements of foreign sugar were still rising. In the first five years after imports of Cuban sugar were banned net imports from foreign countries averaged more than 4.1 million short tons a year, a figure which was just surpassed in the years 1971 to 1975. Already the writing was on the wall, however, and it was becoming apparent that the period of steady growth was over. The following five-year period saw average imports of 4.7 million tons while in the five years to 1985 they fell to less than 2.9 million tons.

Reasons for change are frequently not clear cut and there were several factors which led to the drop in imported sugar. If one root cause has to be pinpointed, however, it was probably the price boom which occurred in 1974 and 1975 which provided the spur to the production of high fructose syrup (HFS) from corn. The technology had been available for some time; now high priced sugar presented it with a market. Substantial investment in new facilities followed and the use of HFS spread rapidly among the producers of soft drinks. Once Coca-Cola announced that its use would be permitted, its market

Mr. Goodwin was for many years the Editor of the *Czarnikow Sugar Review*. He is now a private consultant.

was established; currently there are few mineral water drinks in the USA, outside the diet sector, which are not sweetened with HFS.

Expiry of the Sugar Act

After forty years the Sugar Act, regulating the flow of supplies into the US market, had been allowed to expire at the end of 1974. This brought an end to quotas and the USA become a free market outlet. Domestic producers – and to some extent a few of the smaller suppliers – received fiscal protection but initially this was not greatly required because of the high level of prices which was being paid. As these fell, however, domestic producers complained of financial pressures. This led to dual benefits being granted to them: import duties were raised and a loan program was inaugurated. The latter was meant to provide temporary assistance with carrying charges. In the event it enabled producers to forfeit their sugar leaving the US Government with the task of disposing of it.

A further, though less dramatic, price boom occurred in 1980 and 1981. At that time a new Farm Bill, which included measures to support domestic sugar producers, was being enacted. It is not possible to say to what extent the judgement of legislators was influenced by the high prices then being paid for sugar, but a loan support price was established starting at 17.00 cents per lb in October 1982 and rising to 18.00 cents per lb over the following three years.

This finally undermined the position of the foreign suppliers by underpinning the domestic producers not only of beet and cane sugar but also of HFS. Furthermore, the high support prices of caloric sweeteners encouraged the use, where appropriate, of non-caloric sweeteners.

Import quotas were reintroduced in 1982 after a gap of seven years. They were established on the basis of past performance but unfortunately they were at much lower level than they had been before the break.

With no official limitations to the production of domestic sweeteners it appeared, as import quotas fell year by year, that the projections that no imports would be needed by the end of the decade might not be far from the truth. This year initial quotas totalled only 758,000 tons, after just one million tons in 1987. In the event this has proved to be too small an amount to meet US requirements this year and an increase of around 300,000 tons has since been announced, to bring the total of US quotas for this year to 1,056,675 short tons. Even so, the extent of the fall in the market for foreign sugar in the USA has been considerable. This is clearly illustrated by comparisons showing actual imports into the USA from some of the major origins in 1974, the final year of the old quota system, and in 1982, when they were reintroduced. The further fall in the outlet is shown by the quotas for the current year (Table II).

In fact, despite some of the pessimistic prognostications, it appears likely that there will be an increased US need for foreign sugar next year. This stems from a number of causes. Despite a larger area this season a substantial drop is anticipated in the beet sugar crop. Beet in the Red River Valley region has suffered severely from drought while virus yellows is reported from many parts of California. As a result of this some authorities are suggesting that next season's output of beet sugar could be as much as 600,000 tons below the 3.95 million short tons produced in 1987/88. This, of course, has been one of the main reasons for the recent increase in this year's quota. Meanwhile the rapid growth in the HFS sector appears to be coming to an end. Its natural market in the soft drinks sector has been largely saturated while it is currently operating nearly to the extent of present installations. It is unlikely, therefore, that it will absorb much more of the existing market for caloric sweeteners unless its production in a crystalline form and at an attractive price becomes a practical proposition. All of these factors must be set against a background of a steadily growing demand for caloric sweeteners.

Prospect of increased demand for foreign sugar

The increase in this year's quota will be reflected in the statistics for 1989; even so, some further increase might be anticipated and an import quota next year in the region of 1.2/1.3 million short tons would appear realistic. Therefore, in the absence of any specific action on the part of US authorities to change the existing arrangements, the need for imports will presumably

Table II

	US Imports		*Quotas*
	1974	1982	1988
	Short tons, raw value		
Argentina	109,742	171,027	43,175
Australia	241,702	168,627	83,335
Brazil	783,491	273,277	145,590
West Indies and Guyana (a)	283,332	92,680	47,505
Colombia	104,828	35,542	24,100
Dominican Republic	822,498	362,587	176,710
Mexico	538,113	153	8,000
Peru	488,134	76,223	41,165
Philippines	1,472,556	203,365	158,640
Thailand	26,219	322,224	14,055
Zimbabwe	0	102,152	12,050
Other countries	916,530	829,625	302,350
	5,787,145	2,637,482	1,056,675

(a) Individual country quotas are now awarded but a composite figure is shown for comparison purposes

continue to reflect residuary requirements after domestic supplies have been taken into consideration. The set-back currently indicated for the beet sector cannot be expected to recur; and indeed the attractive prices made possible by the US fiscal arrangements would seem to point to a further expansion in area. On the other hand, of course, it must also be expected that the overall level of consumption of caloric sweeteners will also continue to grow, which will absorb some of the expected extra domestic production.

It is difficult, with so many unknowns, to project further forward than next year but, if current arrangements continue unchanged, expectations of a continued outlet for foreign sugar much in excess of one million tons do not seem to be justified.

The protectionist policies which are now adopted in the sugar sector in the USA run counter to the wishes of the US Administration, which would like the support level reduced. This would make the production of sugar and HFS less attractive. However, although there has been support for this view from some sections, the Congress has so far rejected any proposals which might have led to an increased foreign element in domestic consumption. It is probably unrealistic to expect any change as a result of the elections to be held later this year; whatever might happen at Presidential level, Congress will most probably remain in Democratic hands. This, plus the strength of the corn lobby, not to mention the sugar lobby, must be expected to ensure nothing is done to weaken the current entrenched position of domestic producers.

It must not be overlooked that there is no longer a Sugar Act which could be amended without affecting other commodities. Sugar is now only one element in a comprehensive Farm Bill so that fundamental changes in domestic arrangements will not be attempted lightly. In any case, sugar is no longer the important import commodity it was only one decade ago so interest in it has diminished.

All of that has not stopped various interested parties putting forward suggestions that one group or another should receive preferential treatment in the way in which quotas are allocated. Indeed, currently proposals are being considered which would give preference to low income countries. Past performance would seem to indicate that there is no more chance for this than for the many other proposals which have been considered in recent years.

One other suggestion which surfaces from time to time would enable US refiners to import raw sugar in excess of quota and re-export refined. No matter how this is dressed up, to make it a practicable proposition it would have to entail the provision of a subsidy by the US taxpayer. It is always possible that this will find favour with a new Administration next year, but it appears too late for any effective action to get onto the statute book in 1988.

Influence of GATT

It is possible that action of this type would be considered to run counter to GATT provisions and that might make it unattractive at this time when GATT is looking to dismantle fiscal provisions which affect trade in agricultural products.

The USA has been very forthright in its calls for world-wide tariff reductions in the agricultural sector and has presented a plan to GATT for the phasing-out of all agricultural subsidies over a period of ten years. Other GATT members have proposed less drastic measures but Australia has already stated that it will be taking action to reduce domestic protection for many commodities and industries. In the sugar sector it is intended to replace the present embargo on imports with a reducing tax structure.

In December GATT members will convene in Montreal for the meeting which will mark the half-way stage of the program which opened in Uruguay in 1986. Among its aims are greater liberalization of the commerce in agriculture through, among other things, the reduction of import barriers and increased control over the use of all direct and indirect subsidies. Although there has so far been little progress and it is still difficult to see common ground between some of the important members, proposals have been submitted from several countries and groups of countries; some momentum has now been built up and it is expected that there will be agreement at least not to increase fiscal impediments to trade. From a long-term point of view the GATT proposals might lead eventually to a reduction in the protectionist US sugar policies which have brought such damage to supplying countries.

Summary

The USA has never hesitated to use sugar trade as a political weapon. The removal of Cuba's supply quota is the prime example of this but at various times the sugar industries of the Dominican Republic, Nicaragua and Panama have all been penalised. Quotas have also been awarded on a preferential basis to neighbouring or needy countries. A direct result of the removal of Cuba's quota was an expansion in imports from other suppliers and also an increase in their number, with considerable benefits occurring to them as a consequence of their new entitlements. Now, however, owing to an expansion in sweetener production from domestic sources, the outlet for foreign sugar has dwindled. The immediate outlook is for a probable increase in import needs in 1989 but some reduction thereafter. There has been a series of proposals considered by Congress which might enhance the quotas of one group or another or even increase overall tonnages which might be shipped to the USA but so far have all come to naught and there is little reason to believe future proposals will have any greater chance of success.

The current GATT round is aiming to reduce agricultural support measures. The success rate for international cooperation in commodity affairs in recent years has not been impressive

continued on page 181

Sharing knowledge

The Society of Inter-American Sugar Cane Seminars

Sugar cane is a vital source of food, energy and raw materials which governs the livelihood of many people and economies. To realise its full potential, the knowledge of sugar cane science, technology and management deserves to be freely shared and disseminated in a scientific, non-commercial setting.

This is the philosophy of the Society of Inter-American Sugar Cane Seminars, a non-profit society that organizes the annual Seminars and similar events in the Western Hemisphere where advances and experiences in every facet of sugar cane and its by-products are presented and openly discussed.

The Seminars take place yearly at Miami's James L. Knight Convention Center, where the opening session, speakers' presentations, panel discussions and award ceremonies are held with simultaneous interpretation. The Seminar proceedings are published in English and Spanish and become a valuable collection of sugar cane science and technology. The City of Miami offers excellent facilities for the convenience of the participants in these or any other similar events organized by the Society. Also, the Florida sugar cane area and research institutions are not far away.

Field visits to such institutions are a rewarding experience, and have provided the opportunity to meet pathologists, entomologists and plant breeders at the USDA Sugarcane Field Station in Canal Point; observe the work of soil scientists and agricultural economists at the EREC Station of the University of Florida, Belle Glade; learn about management of South Florida resources at the South Florida Water Management Computer Center and Pumping Stations, and alternative energy from biomass at Ona, Florida, etc.

Topics discussed in previous Seminars have been sugar cane diseases; insect and rodent pests; varieties and breeding; soil fertility and management; weed control and ripeners; irrigation and drainage; energy and by-products from sugar cane; and sugar uses, energy and by-products.

The 1988 Inter-American Sugar Cane Seminar, to take place during September 21 - 23, will cover three related themes of current importance: Computers, Automation and Management in the sugar industry. These areas are undergoing rapid and profound changes and creating great interest in the sugar community. At the Seminar, participants will have the opportunity to be updated on operational management techniques for crop production and /or processing; management, coordination and organization of field and factory operations, machinery and personnel; systems automation, computerization and computer-aided management of field, factory and office operations; as well as decision making aids such as software available for data management, statistical analysis and quality assurance, among many other aspects of computer applications.

This year, the day normally devoted to a field tour will be used to demonstrate computer software programs. Specialists from the University of Florida will demonstrate computer applications dealing with field operations, financial management and other types of decision aids that are applicable to sugar cane operations. There will be a general session to demonstrate, with the aid of a projector, the operation of several computer programs, while several microcomputer stations will be set up in order that small groups of participants may become more familiar with these programs by interacting with the persons giving the demonstrations. The President of the Society, Mr. Diego R. Suárez, and the Chairman of the Technical Organizing Committee, Dr. Alfonso L. Fors, are committed to making the 1988 Seminar an outstanding event.

The sponsors and co-sponsors

The sponsors of the Seminars are the City of Miami and Inter-American Transport Equipment Company; the co-sponsors include leading universities, research facilities of the US Department of Agriculture, the newspaper *Diario Las Américas* and the Organization of American States.

Miami is a crossroads between the Americas and a gateway to the rest of the world. As an international port for people and products, its accessibility, central location, sub-tropical climate and excellent hotel, dining, entertainment and convention facilities create an exceptionally pleasant environment for the scientists and technologists taking part in the Seminars. Further, Miami is close to one of the most fertile cane growing areas and important sugar producing industries of the Western Hemisphere in which the importance of the latest technology is well recognized. Sponsorship of the Seminars by the City of Miami demonstrates its acknowledgment of the importance of the sugar industry to the well-being of the state of Florida and of the city itself.

Inter-American Transport Equipment Company is well known for its range of agricultural equipment for the sugar cane industry, from soil cultivation implements to Thomson whole-stalk and Claas chopper harvesters, the latter built for the company in Germany. Design, development and assembly is carried out in Miami, as is much of the construction. Even tyres are custom-built to specifications laid down by the company to meet the standards set for Vanguard equipment, which takes its name from a small town outside the city of Havana where Mr. Diego R. Suárez, President of the company, began the design and manufacture of cane trailers during the early 1950's.

The Everglades Research and Education Center (EREC) in Belle Glade, Florida, one of the co-sponsors of the Seminars, is one of several operated by the Institute of Food and Agricultural Sciences (IFAS) of the University of Florida. EREC is unique because it is the only academic agricultural research

centre located on subtropical organic soils in the United States. The farming area around the southern end of Lake Okeechobee produced more than $1500 million in sales of agricultural products with approximately $700 million of this related to the sugar industry in 1987-88. EREC has active research and extension programs that will improve sugar cane production practices and conserve and protect soil and water resources in southern Florida. Specifically the centre is participating in a sugar cane breeding program at Canal Point, Florida, developing best management practices, studying the population dynamics of white grubs, and initiating work on pineapple disease of sugar cane.

The University of the West Indies mainly services the English-speaking Caribbean islands. Included in this grouping are the sugar growing countries of Guyana, Belize, Barbados, St. Kitts-Nevis and Trinidad & Tobago. Sugar for many years has been the mainstay of the economies of these islands, especially the non-oil producing territories of Belize, Barbados and Guyana. Sugar technology research and development was formerly pursued at the Imperial College of Tropical Agriculture at St. Augustine, and a tremendous amount of basic research was done at that institution. The University of the West Indies as its successor institution, with its faculties of Agriculture and Engineering, has continued this tradition of research and teaching in the areas of sugar cane and its by-products. A final year optional course in sugar technology is offered for B.Sc. (Eng.) students in the Chemical Engineering program. Continuing Education courses are held in such areas as "Sugar factory maintenance" and "Pan boiling operations". Research has centred under the following basic heads: Development of new processing techniques; Analysis of processing problems; Energy conservation; Pollution control and waste utilization; Analytical techniques; Computer applications; and Ethanol production. The role of the University as co-sponsor of the Inter-American Sugar Cane Seminars allows it to share its knowledge and gain some insights into sugar cane production and processing research, especially in the Caribbean basin.

The annual value of the Louisiana sugar cane crop is approximately $275 million. The close proximity of producers and processors and the extensive use of specialized, locally-manufactured equipment create a sizeable economic impact on the communities where these operations are located. Consequently, the Louisiana cane sugar industry contributes significantly to the economy of the state. The history of the Louisiana sugar industry has been characterized by consolidation, expansion and technological advancement. A century ago there were 1200 raw sugar factories in the state; the number has decreased steadily as centralized factories expanded to process the cane from neighbouring farms. The state now has 21 raw sugar factories, with an average processing capacity of more than 5000 short tons of cane per day. Although the number of producers has decreased to some 800, the acreage used for sugar cane cultivation has remained stable. As with other agricultural industries, these trends are expected to continue. The most efficient will compete, while the relatively inefficient will find it more difficult to survive. As members of the Louisiana sugar cane industry strive to increase their efficiency, they will look to the Louisiana State University Agricultural Center for new knowledge and technologies. The generation of relevant knowledge and technology is the end process that begins with the setting of problem area priorities and culminates with creative thinking by research scientists. Creative thinking and the conception of new ideas are stimulated by professional interaction. Accordingly, the Louisiana State University Agricultural Center is most willing to co-sponsor Seminars which share this philosophy.

The US Sugarcane Field Laboratory at Houma, Louisiana, conducts research in the areas of germplasm enhancement and improvement of production practices for sugar cane grown under sub-tropical conditions. Because of the applied nature of the research, the Laboratory strives to transfer rapidly technology for use by producers and processors of sugar cane in the U.S.A. and particularly to those users in the Lower Mississippi Delta region of the country. The scientists at the Laboratory are also actively involved in exchanging research results with other scientists that work with sugar cane throughout the world. The Inter-American Sugar Cane Seminars have become an excellent vehicle for both the dissemination and exchange of information. The themes for each Seminar are timely, and the presentations are organized to allow for a comprehensive review of the chosen subjects. The Houma Laboratory, as a co-sponsor, looks forward to continued support of the Seminars.

Other co-sponsors of the Seminars include the College of Engineering and Applied Sciences in the Florida International University; the Department of Agriculture in Nicholls State University in Louisiana; the College of Agriculture in the University of Georgia; the University of Puerto Rico Mayagüez Campus; the USDA Agricultural Research Service facility at Weslaco, Texas; *Diario Las Américas* and the Organization of American States.

continued from page 176

Brazil discussed the economic value of cane varieties.

Following the conference a visit was arranged to the Tucumán Sugar Experiment Station, led by Dr. Mariotti, where current work was available for inspection and adds to the illustrious record of agricultural and industrial research carried out there since 1914.

continued from page 179

and hopes should not be too high, but if concerted moves are eventually taken to lower fiscal support for domestic producers it is probable that US domestic sugar growers will reverse their recent policy of expansion, leaving greater opportunities for foreign suppliers.

Practical aspects of the control of dextran at Atlantic Sugar Association*

By José F. Alvarez and Hector Cardentey
(Atlantic Sugar Association, Belle Glade, Florida, USA)

Atlantic Sugar Association (ASA) is a sugar mill located in the state of Florida, 15 miles east of Belle Glade. We have a nominal grinding rate of 10,000 short tons per day and, on the average, our total throughput of sugar cane is 1,100,000 tons.

Our harvesting is split between hand-cut cane and mechanically-cut cane, with 70% of our cane cut by hand. We harvest during the daylight hours, storing enough cane for night grinding. Our cane is stored in 20-ton trailers and in an open cane yard, where the cane is handled by payloaders.

In 1981 ASA, along with the Florida sugar industry, faced the problem of controlling dextran. Refineries were beginning to impose penalties on sugars with high levels of dextran. The penalties were significant enough to raise the eyebrows of every sugar producer in Florida.

Our first instinct was to research the work that had been previously done on dextran. We found that dextran was a polysaccharide, formed during decomposition of sugar when it is attacked by a micro-organism, *Leuconostoc mesenteroides*. This micro-organism is ever-present in the environment, and it thrives in warm and humid conditions.

Most of the research indicated that the deterioration of cane is primarily affected by burning and climatic conditions (as shown in Figure 1), by the billet length (as shown in Figure 2) and by the time from burning to cut to crush (as shown in Figure 3). We can summarise this research by saying that:

A. Burning and climatic conditions affect the deterioration of sugar cane.

B. Billet length and the condition of cane is related to the deterioration rate.

C. The longer the cane is exposed from the time of burning, the more it deteriorates.

This research led us to identify three critical parameters: (1) condition of the cane; (2) environment; and (3) the time from burn to milling. If we could control these critical parameters, we could control dextran. A healthy, whole stalk of cane was found not to have dextran. It is only after it is burnt, that the dextran formation begins, indicating that the protective wax covering is destroyed during the burning, allowing the micro-organism to penetrate the epidermis. The length of the billet is a factor. The more exposed area, the more rapid is the deterioration, and consequently the higher the dextran level in the cane.

The environment is the second important factor; warm weather, high humidities and rain are ideal conditions

* This paper received "The George Samuels Award" when it was presented at the 1987 Inter-American Sugar Cane Seminar.

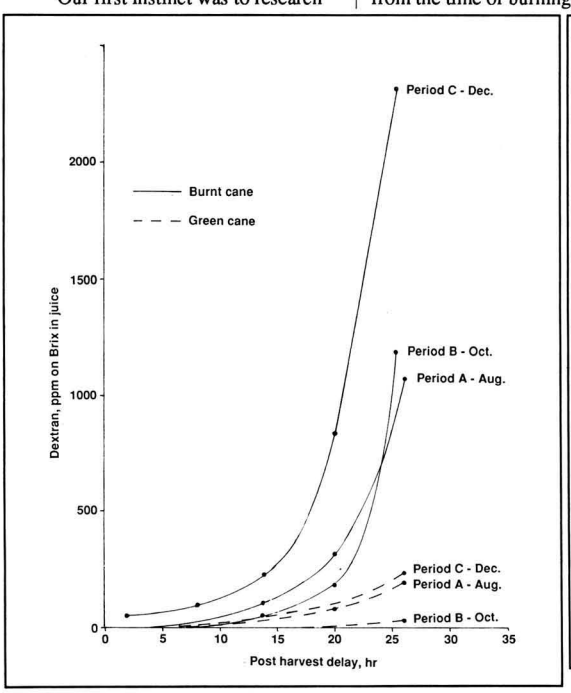

Figure 1. Effect of burning and climatic conditions on the deterioration rate of chopped cane

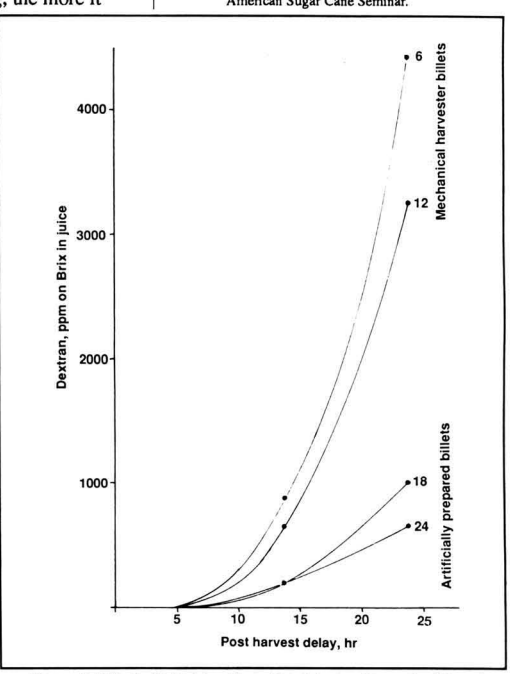

Figure 2. Effect of billet length on the deterioration rate of burnt cane. Plotted points are arithmetic means of 25 determinations during 2.9.71 - 13.12.71

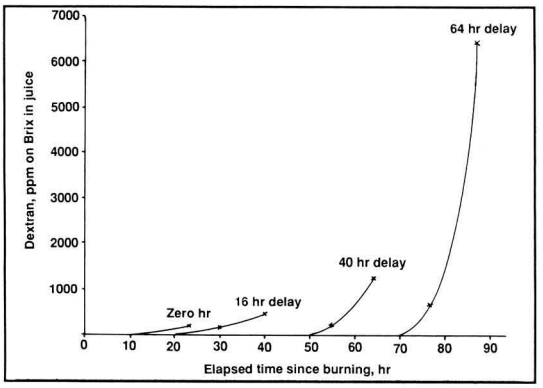

Figure 3. Effect of burn to cut (B/C) and cut to crush delays on the deterioration rates of chopped cane

for the reproduction of the micro-organism. Cane exposed to these conditions had a higher level of dextran.

The time from burning to crushing was the third important parameter. It made sense that the longer the cane was allowed to stay in the exposed condition, the higher the level of dextran, since the micro-organism synthesizes dextran at a geometric rate.

Changes made at Atlantic Sugar Association

Having identified what we felt were the critical parameters, the next step was to bring about changes in our agricultural and mill practices that would tend to minimize the formation of dextran. The changes that were implemented were the following:

A. Burn only the cane that will be hand cut within 24 hours.

B. Burn the cane to be harvested mechanically on the same day.

C. Postpone the burning of cane when the mill may shut down because of inclement weather.

D. Keep blades on harvesters and loaders sharp to avoid chopping the cane and damaging the stalk.

E. Reduce the amount of cane stored in piles and reduce the total time of storage.

F. Store hand-cut canes in piles since they have longer billets than mechanically-cut cane.

G. Install back sweepers on payloaders handling cane in the cane yard to avoid running over the cane on the ground.

H. Grind the cane on the basis of first-in, first-out.

I. Determine the optimum time from burn to mill of the hand-cut cane and mechanically-cut cane.

J. Test for dextran on a daily basis to develop data for further analysis and to identify the level of dextran in the sugars.

K. Keep the hard surface of the storage area sanitized.

L. Keep conveyors and mill clean with steam and hot water.

M. Apply surfactant to the stream of *B*-molasses to avoid high viscosities.

N. Avoid long retention of mixed and raw juice in juice tanks and in maceration tanks.

O. Identify and record the dextran level of the sugars in the warehouse for future blending.

P. Determine the levels of dextran in raw juice, dilute juice, clarified juice, syrup, molasses, and sugars.

Results and conclusions from the Atlantic experience

These changes were implemented and after several seasons of accumulating data and experience, we reached the following results and conclusions.

A. Dextran level on sugars was reduced by three-quarters.

B. The optimum delivery time for cane was found to be 40 to 48 hours for mechanically harvested cane, and 60 to 72 hours for hand-cut cane.

C. With temperatures in the neighbourhood of 80°F and in high humidities, the time of delivery becomes more critical.

D. Cane stored in trailers have lower dextran levels than cane stored in the cane yard.

E. Reducing the time cane is stored in the cane yard reduces the formation of dextran.

F. The dextran is formed in the sugar cane. Once it enters the process, no significant further amounts are generated, while there is no evidence to indicate that it is destroyed, and most of it leaves in the filter muds, molasses and sugars.

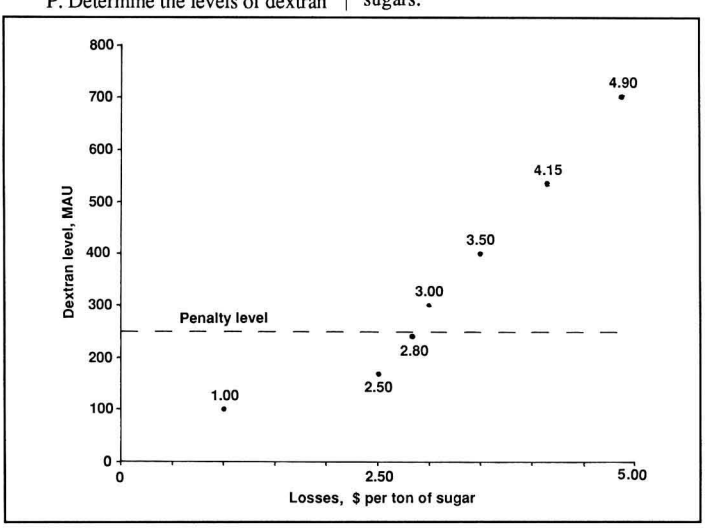

Figure 4. Dextran losses for level of MAU

G. The losses of recoverable sugar to dextran are significant.

We know that healthy cane has zero dextran. Since we analyse the dextran in the crusher juice, we have determined the losses in sugar from the time of burn to crushing.

Figure 4 shows that losses in sugar, assuming a price of 18 cents per pound, can be substantial for dextran levels above 500 MAU. Although the penalty begins at 250 MAU, the losses at this level in recoverable sugars are already $2.90 per ton of sugar. In addition, the penalties presently imposed on sugar can result in substantial dollar losses (Figure 5).

As can be seen from the graph (Figure 6), the penalty curve is parabolic in nature; this means that the penalties accelerate as dextran increases. Again, assuming 18 cents per pound of sugar, the penalties on a shipment of 20,000 tons could total $56,800 for 350 MAU sugar, and as high as $194,400 for 550 MAU.

In addition to the losses in sugars (from the time the cane is burnt until it is crushed plus the penalty losses), dextran can affect the crystallization and centrifugalling of sugar massecuites.

We estimate that the total losses in terms of reduction in yields, losses in recovery of sugar, and losses in production, warrant immediate attention at all levels of a sugar cane operation.

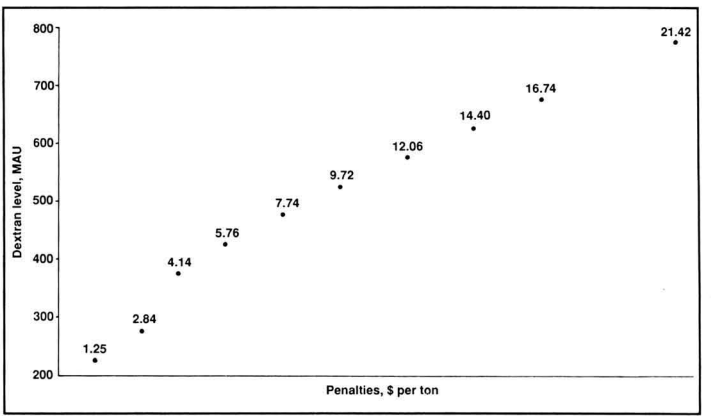

Figure 5. Dextran penalties on sugar, dollars per ton

To illustrate the impact on yield, we plotted yield and dextran against crop days (as shown in Figure 7). The significant conclusion we can draw from the selected crop days is that, whenever the level of dextran in sugar has gone up to the 600 MAU level, the yield has dropped by approximately ten percentage points. This illustrates the importance of controlling dextran in sugar.

Summary

The introduction of dextran penalties in sugar precipitated a program to control dextran at Atlantic Sugar Association. Critical parameters were identified and changes were made in agricultural and mill practices to minimize the conditions that increase the level of dextran in cane. After several seasons of accumulating data and practical experience, practices were established to bring dextran under control.

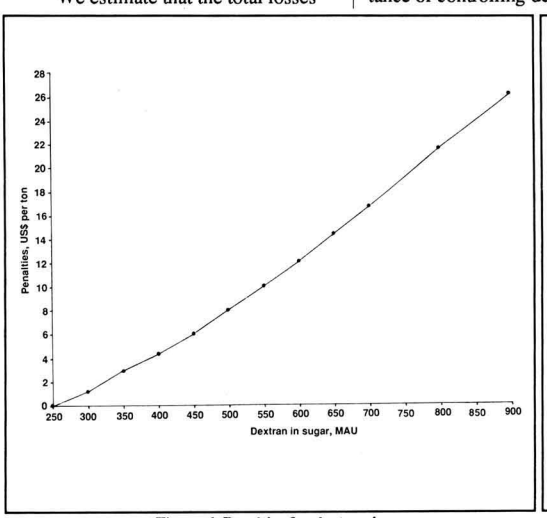

Figure 6. Penalties for dextran in sugar

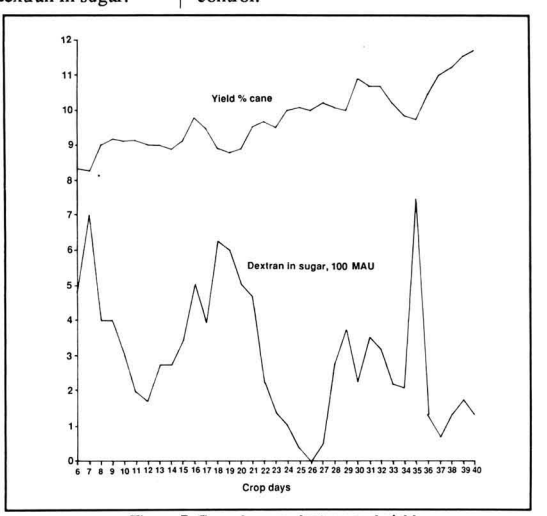

Figure 7. Crop days *vs.* dextran and yield

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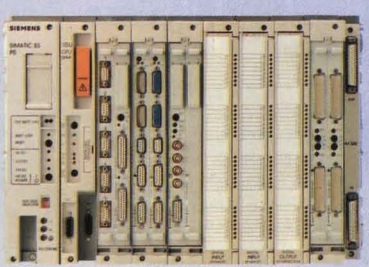

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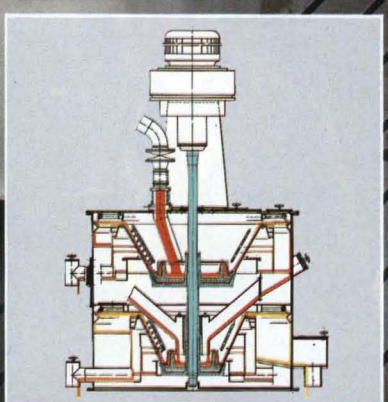

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Study of 5-hydroxymethyl furfural (HMF) in juice from burnt sugar cane

By Asavari D. Kulkarni, H. M. Modak and S. J. Jadhav
(Deccan Sugar Institute, Manjari Bk., Pune, India 412307)

Introduction

Preharvest burning of sugar cane is a regular practice in many countries. 5-Hydroxymethyl-2-furancarboxaldehyde (hydroxymethyl furfural or HMF) is an established degradation product of hexose-yielding carbohydrates formed under the influence of organic/inorganic acids and temperature[1]. It was thought that cane juice, one of the primary source of such carbohydrates, if obtained from sugar cane burnt as mentioned above, under the influence of inherent acid content as well as the high temperature prevailing during burning, might contain higher amounts of HMF than that of unburnt cane. This logic prompted us to investigate HMF contents of juice from burnt sugar cane. In this communication we present details of our successful attempt to detect and quantify HMF in the juice obtained from the cane cultivar Co 671 burnt when mature and crushed immediately afterwards.

Materials and methods

Sample preparation

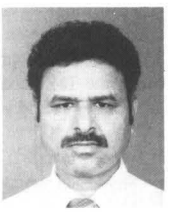
Cane of cultivar Co 671, ready for crushing, was selected for the study. The plantation was divided into two parts, one of which was burnt as usual. Both the burnt (BS) and unburnt sugar cane (away from burnt area, US) were harvested and immediately crushed in a small mill, separately, preventing any contamination.

US and BS juices (5 litres each) were extracted separately, at room temperature, with ethyl acetate (3 × 1400 ml). Some emulsion formed at the boundary as the layers separated was cleared using brine and hexane in small quantities and by centrifugation at 2000 rpm. The clear organic solvent extracts were each treated with activated charcoal (15 g). They were then vacuum filtered and used for analysis as needed. The procedure was repeated thrice, with separate analyses.

Preparation of standard HMF

A standard sample of HMF was prepared as per the reported procedure[2].

A. D. Kulkarni



S. J. Jadhav

UV spectrophotometry

Ethyl acetate extracts from the original stock solutions (25 ml) both of US and BS were evaporated under vacuum at 45°C. The residues were dissolved in spectroscopy grade ethanol and volumes were made up to 25 ml.

The UV spectra for BS, US and standard HMF samples were recorded using a Shimadzu UV/visible spectrophotometer Model UV 240 and are illustrated in Figure 1.

Gas chromatography

Stock solutions of the ethyl acetate extracts mentioned above were used as such. The standard HMF, BS and US samples were analysed using a Hewlett Packard Model 5790 A gas chromatograph with 3390 A integrator, equipped with a Carbowax 20 M (5%) column supported on Chromosorb W-AW-DMCS (mesh size 80-100), a stainless steel column $^1/_8$-in × 2 m, and a flame ionization detector. The temperature of the column oven was 195°C and those of the injector and FID 250° and 300°C, respectively.

High performance liquid chromatography

Standard HMF: The standard sample of HMF (1.637 g) was dissolved in HPLC-grade methanol (10 ml) and 1.5 ml of this solution was diluted to 25 ml with the mobile phase. Of this 25 ml, 0.25 ml was further diluted to 50 ml with the mobile phase.

Juice from burnt sugar cane (BS): The solvent from the extract was completely evaporated off under vacuum at 45°C and the residues (0.678 g) dissolved in HPLC-grade methanol. 2.5 ml of this solution was diluted to 25 ml with the mobile phase.

Juice from unburnt sugar cane (US): The solvent from the extract was completely evaporated off under vacuum at 45°C and the residue (0.778 g) dissolved in 10 ml of HPLC-grade methanol. 3.5 ml of this solution was diluted to 10 ml with the mobile phase.

Operating conditions: The analysis was done by using Waters HPLC modular equipment consisting of the pump No. 510, UV detector No. 481 and data module No. 730 in isocratic mode.

1 Szmant & Chundury: *J. Chem. Technol. Biotechnol.*, 1981, **31**, 135 - 145.
2 Brown *et al.*: *ibid.*, 1982, **32**, 920 - 924.

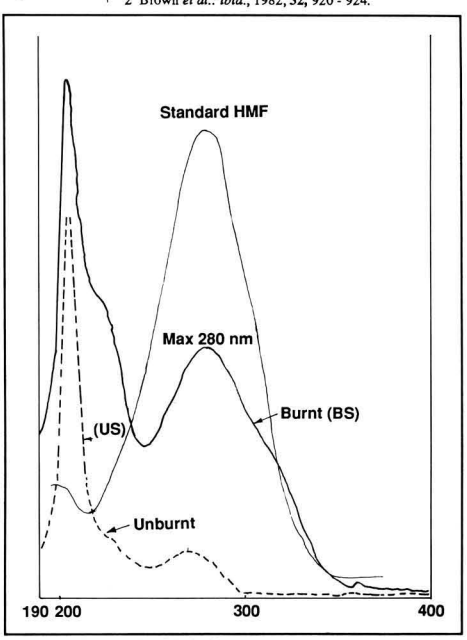


Fig. 1. U.V. analysis of juice from unburnt and burnt sugar cane

Injections were made manually (10 µl). A Radial Pak C-18/RCM 100 column with Guard-Pak precolumn module was used. The mobile phase was 20% aqueous methanol. The other typical conditions for the HPLC system were as follows: flow rate 1.5 ml/min; chart speed 0.2 cm/min, and UV detector at 280 nm/0.2 AUFS.

Results

UV analysis

Quantitative scans of the UV spectrum (Figure 1) taken for the same quantity of US and BS juices after due treatment, when compared with that of standard HMF sample, indicated the presence of HMF (λ_{max} 280 nm), in both cases. However, the peak was more pronounced in BS than in US. Since both scans were obtained by treating exactly the same quantity of juice, it can be said that the HMF content of BS was greater than that in US.

GC analysis

The gas chromatographic patterns of BS and US juices on comparison showed that the overall composition of BS was very different from that of US. Further, comparison with the standard sample established the presence of HMF in both US and BS, on the basis of the retention time (Figure 2). Thus, the GC scan corroborated the finding by UV analysis that the HMF content in BS was greater than that in US.

HPLC analysis

In order to determine the exact quantities of HMF in BS and US juices, the samples were subjected to HPLC analysis. The scans further corroborate the GC findings that the overall composition of BS was different from that of US (Figure 3).

The standard sample of HMF was used to calibrate the response of the detector. On the basis of this calibration, it was estimated that the HMF content of BS was 1.10934 mg/litre (1.109 ppm) and that of US was 0.39706 mg/litre (0.397 ppm).

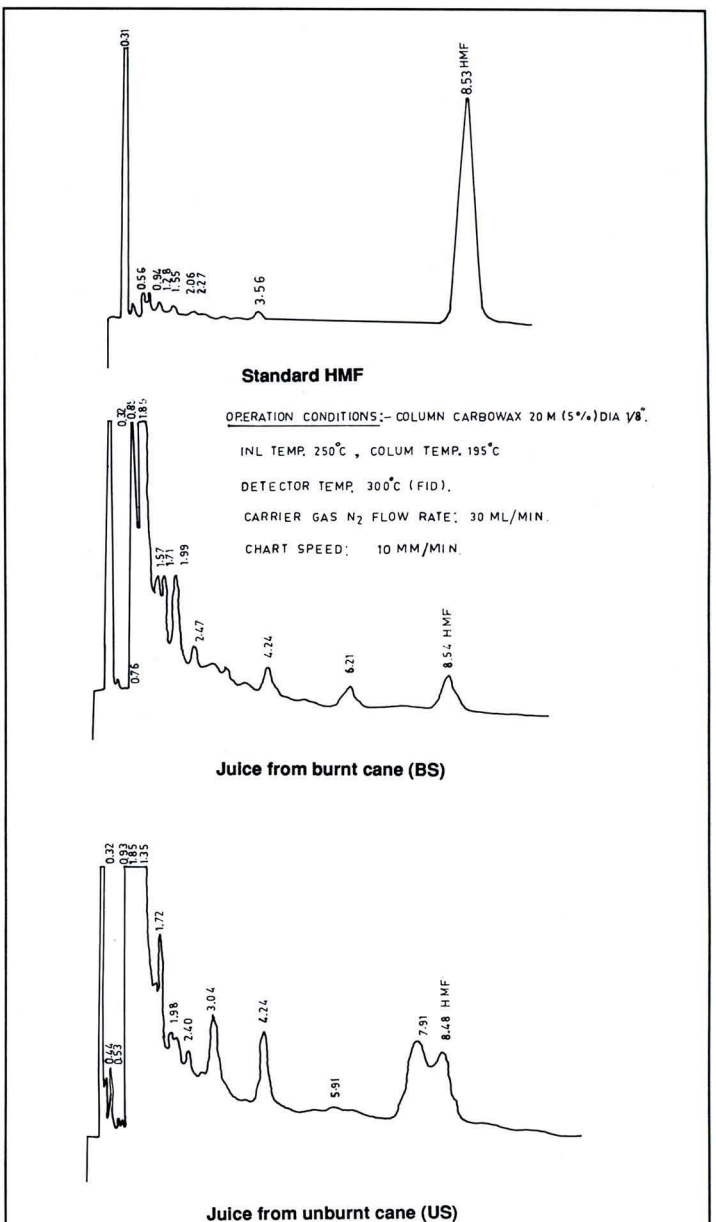


Fig. 2. G.C. analysis of juice from unburnt and burnt sugar cane. *Operation conditions:* Carbowax column; dimensions 20 m (5%) $\times 1/8$-inch dia.; inlet temp. 250°C; column temp. 195°C; detector temp. 300°C (FID); carrier gas N_2; flow rate 30 ml/min; chart speed 10 mm/min

Discussion

Comparison of the contents of HMF in the free state in BS and US juices indicates that it is three times greater in the former than in the latter. This is quite significant considering that the juices were isolated immediately after harvesting. Delay might have increased the HMF contents further.

It is well known that burning of sugar cane increases the amount of reducing sugars[3] in it. Also, HMF is known to be produced preferentially from fructose[4]. Thus it was expected that HMF contents in burnt cane, which also contains acids having the ability to degrade the reducing sugars to HMF, would be higher than in unburnt cane.

HMF is well known to be one of the important factors responsible for colour formation in sugar[5-7]. A significant correlation between HMF content and colour formed has been experimentally established[8].

The subject of colour formation in substrates containing sugar has been reviewed[9]. Two mechanisms of colour formation involving HMF can be identified. The first involves hydrolysis of sucrose to a mixture of glucose and fructose, followed by high temperature decomposition of fructose into HMF. Interaction of HMF with glucose[10-12] or its own polymerization[13,14] gives rise to colour bodies.

In the second mechanism, interaction of amino acids with HMF (Schiff's base formation) further increases colour body formation in the Maillard reaction. This was proved by the increased colour formation in the

3 Chen: "Cane sugar handbook" (Wiley, New York), 1985, p. 15.
4 Moye & Krzeminski: *Australian J. Chem.*, 1963, **16**, 258 - 259.
5 Chen: "Cane sugar handbook" (Wiley , New York), 1985, p. 36.
6 Idem: *Proc. 14th Congr. ISSCT*, 1971, 1589 - 1600.
7 Cheng & Wang: *S.I.A.*, 1984, 313.
8 Mizushima: *Proc. Research Soc. Japan Sugar Refineries' Technol.*, 1965, **15**, 98 - 104.
9 Brown & Kelley: *Sugar Technol. Reviews*, 1978, **6**, 2 - 47.
10 Cantor *et al.*: *J. Amer. Chem. Soc.*, 1948, **70**, 517.
11 Scrozynski & Boruch: *Chem. Abst.*, 1967, **67**, 108870.
12 Bergdoll & Holmes: *Food Res.*, 1951, **16**, 50.
13 Tegge: *Staerke*, 1966, **18**, 285.
14 Cantor & Peniston: *J. Amer. Chem. Soc.*, 1940, **62**, 2113.

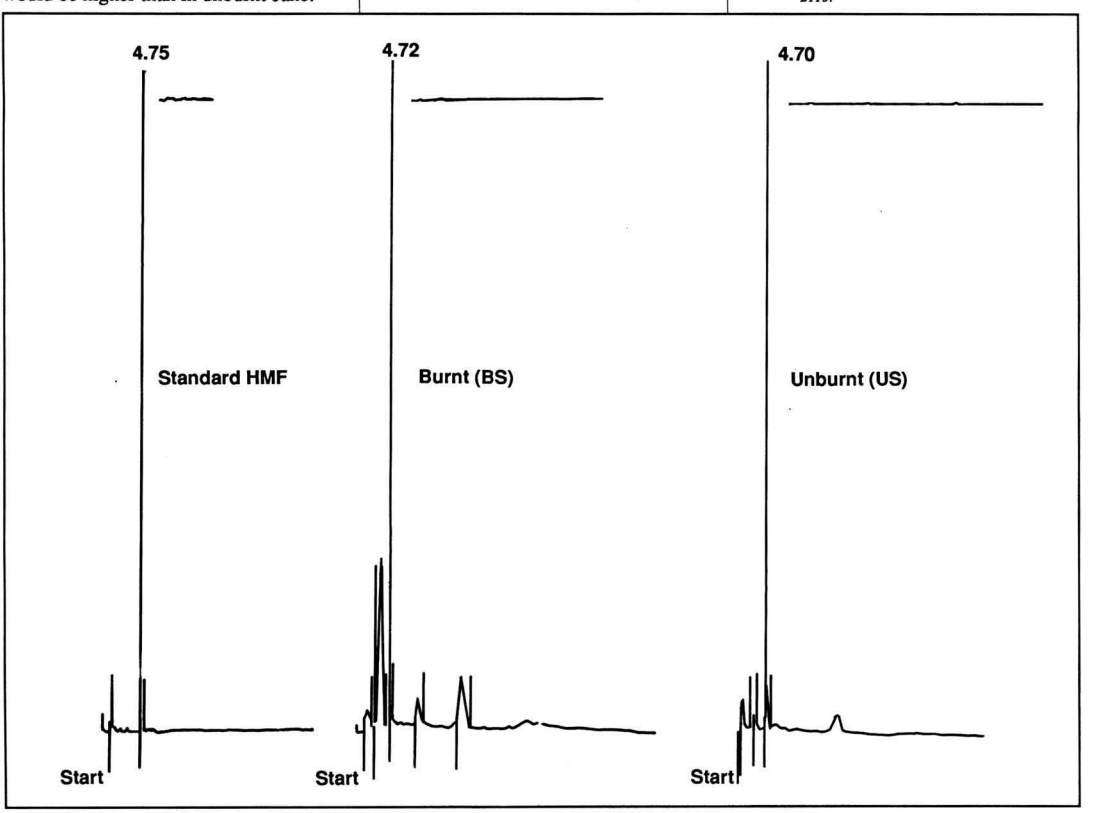


Fig. 3. HPLC analysis of juice from unburnt and burnt sugar cane. *Operation conditions:* Radial Pak column C18/RCM 100 with Guard Pak precolumn module, dimensions 10 cm × 8 mm i.d.; solvent 20% aqueous methanol; flow rate 1.5 ml/min; chart speed 0.2 cm/min; detector U.V. 280/0.2 AUFS

leucine, HMF and glucose system[10] as well as in a glycine, HMF and glucose mixture at higher temperatures[15]. It was concluded that HMF is an important precursor in the formation of Maillard products[16] and this has also been corroborated by others[17,18].

A number of reports have been discussed[9] which illustrate the mechanisms involved. The final conclusion is that, although HMF is not the primary or exclusive cause, it constitutes an important factor in colour formation.

As mentioned earlier, the high temperature reached during cane burning brings about appreciable destruction of sucrose and also promotes some reactions which form colour bodies[19]. This was also observed when we processed the samples of juice from burnt and unburnt cane. BS juice was darker and difficult to filter by comparison with US juice.

It appears that HMF is the factor responsible for the increased colour formation found experimentally in BS juice. This is likely to create problems during subsequent processing, with effects on clarification efficiency, massecuite quality, overall yield and product quality, as well as storage behaviour of the final product.

It has been mentioned[9] that most of HMF and its products are eliminated in processing, especially during sulphitation. However, it should be borne in mind that the HMF content in BS is higher than in US, even in the immediately obtained juice. It may be much more so in juice obtained after a time period (which is more likely in a sugar factory). The increased quantity of HMF will not necessarily be fully eliminated under normal operating conditions and this could affect operations on the lines of the possibilities mentioned above.

Conclusions

The foregoing study overall corroborates the point emphasised earlier[19] that burning of sugar cane may cause problems and ideally it should be avoided.

Summary

Mature sugar cane of the cultivar Co 671 was burnt and juice obtained immediately afterwards. This, and juice from unburnt cane, were processed and analysed for their HMF contents. UV, GLC and HPLC analyses were carried out, making comparisons with a standard HMF sample. The HMF content in burnt sugar cane was found to be three times greater than in the unburnt cane. The cause of this and its possible effects on processing are discussed. By reference to the known role of HMF as an intermediate in colour body formation, it is concluded that the practice of burning cane could affect processing operations and sugar quality.

Acknowledgement

We thank Dr. D. G. Hapase, Director and Mr. H. D. Mohite, Chief Executive, Deccan Sugar Institute, Manjari Bk., Pune, for providing support for this work. Help from Mr. A. D. Wele and his associates is gratefully acknowledged.

Estudio del 5-hidroximetil furfural (HMF) en jugo de caña de azúcar quemada

Caña de azúcar madura del cultivar Co 671 fue quemada y el jugo fue obtenido inmediatamente después. Este jugo, y el obtenido de caña no quemada, fueron procesados y analizados para conocer su contenido de HMF. Se llevaron a cabo análisis de UV, GLC y HPLC, comparando con una muestra estándar de HMF. Se encontró que el contenido de HMF en caña de azúcar quemada era tres veces mayor que el contenido en la caña no quemada. Se discute la causa de esto y sus posibles efectos en el procesamiento. Por referencia se sabe que el HMF juega un papel como intermediario en la formación de color y se concluye que la práctica de quemar la caña podría afectar las operaciones de procesamiento y la calidad del azúcar.

Etude du 5-hydroxymethyl furfural (HMF) dans le jus provenant de canne à sucre brûlée

On a brûlé de la canne à sucre mûre de la variété Co 671 et on en a préparé du jus tout de suite après. Ce jus, ainsi que du jus provenant de canne non-brûlée, ont été travaillés et analysés pour leur teneur en HMF. Des analyses UV, GLC et HPLC ont été effectuées, tout en utilisant comme étalon un échantillon standard de HMF. La teneur en HMF dans la canne brûlée était trois fois supérieure à celle dans la canne non-brûlée. On en discute les raisons et les effets possibles. En se basant sur le rôle connu du HMF comme produit intermédiaire dans la formation des matières colorées, on conclut que la pratique de brûler la canne peut affecter les conditions du travail en usine et la qualité du sucre.

15 Wolfrom *et al.*: *ibid.*, 1949, **71**, 3518.
16 Doss & Ghosh: *Proc. Sugar Tech. Assoc. India*, 1949, **18**, 26.
17 Hass *et al.*: *J. Amer. Chem. Soc.*, 1948, **70**, 3576.
18 Mendel *et al.*: *Biochem. J.*, 1954, **56**, 639.
19 Foster: *Proc. 17th Congr. ISSCT*, 1980, 1.

Facts and figures

Puerto Rico sugar production, 1987/88[20]

Sugar production in Puerto Rico reached 87,470 tonnes in 1987/88, somewhat more than in the previous season. The cane area was reduced by 5% to about 20,000 ha but better weather conditions gave higher yields so that the cane crop was only reduced to 1,010,000 tonnes against 1,040,000 tonnes in the previous season. In 1988/89 an expansion of the cane area by 5% is expected and an increase in sugar production.

Drought over in Cuba[21]

The severe drought which has affected Cuba for the past four years is over and there is optimism that 1988/89's target of 8 million tonnes of raw sugar will be met. Workers have responded to President Castro's call to work through the traditional July/August holiday period to clear the cane fields of weeds. The higher prices on the world market have also been welcomed as improving income prospects in 1989; however, the 1987/88 crop is possible insufficient to meet commitments this year so that purchases may need to be made from the world market and high prices may be a mixed blessing.

20 *Zuckerind.*, 1988, **113**, 551.
21 *Financial Times*, July 29, 1988.

ISJ Abstracts

Cane sugar manufacture

Industrial application of a sugar deterioration retarding treatment using lime as an alkalizing agent

E. L. Ramos A., J. A. Urrutia F. and R. G. González Z. *CubaAzúcar*, 1986, (Jan.-March), 3 - 7 *(Spanish)*.

Raw sugar deterioration in bulk storage is a cause of loss and has been reduced by the treatment of syrup with NaOH to render it alkaline[1]. Subsequent studies have now shown that lime can be used as successfully and more economically for the same purpose.

Evaluation of dialkyldithiocarbamate (Antiformin) as a disinfectant in the cane sugar industry

S. Acosta D., C. Rodríguez C. and E. Duarte P. *CubaAzúcar*, 1986, (Jan.-March), 17 - 22 *(Spanish)*.

Of micro-organisms in Cuban cane juice 60 - 70% comprises *Leuconostoc* and *Bacillus* spp., 10% are other bacteria and the rest yeasts. They cause loss of sucrose and trials were made to determine the effect of the title disinfectant. These included laboratory experiments where the effect of antiformin was determined by measuring changes with time of pol and reducing sugars in cane juice to which invertase had been added; the antiformin reduced sucrose loss and had a limited residual effect. Shock dosing experiments in the laboratory showed that 17,600 ppm of antiformin was needed to reduce the *L. mesenteroides* content by 90%. Other tests involved continuous addition of 15 ppm of antiformin in the 3rd mill juice tank which had been shown to be where infection was greatest. While the experiment was conducted the content of micro-organisms was reduced (by 63% of *Leuconostoc* spp. and 87% of yeasts).

Notes for the study of corrosion in the area of extraction

R. Monduí G., E. Angulo A. and T. Llanes O. *CubaAzúcar*, 1986, (Jan.-March), 23 - 27 *(Spanish)*.

The effects have been studied of pH, oxygen content, flow rate and the presence of alloying elements (Ni, Cr, Cu, etc.) on the corrosion of cast iron in cane juice, and the beneficial influence of the alloying elements is noted. Aspects of the mechanism of corrosion in these conditions are discussed as well as the effect of the composition of the cast iron, especially the phosphorus content, increase in which exerts a beneficial effect.

Laboratory study of the insulation of the Fe-Cu couple for evaporator tubes and plates with ED16 resin

J. C. Bango B. and L. Gutiérrez P. *CubaAzúcar*, 1986, (Jan.-March), 35 - 37 *(Spanish)*.

Tests were made to simulate real conditions in an evaporator for insulation of iron from copper by means of the resin in which varying weight ratios of catalyst and resin were employed and rupture strength measured to evaluate the index of adherence. A ratio of 1:6 was found to be the best for joining tubes to plates satisfactorily and withstanding boiing and attack by hydrochloric acid.

Technico-economic analysis of a scheme for heating-evaporation with contact heaters

M. Salermo, O. Santana and C. Vázquez. *CubaAzúcar*, 1986, (Jan.-March), 43 - 46 *(Spanish)*.

A direct-contact heater has been designed and tested by ICINAZ, the Cuban Sugar Research Institute, and its performance compared with the heater designed in Australia[2]. It is of higher technical and economic efficiency and trials will continue, but the authors are not convinced that this type of heater is the best solution.

Studies for the improvement of mill shafts

L. C. Felício, R. Mazzafera and M. Miayesi. *Bol. Técn. Copersucar*, 1986, (34/86), 27 - 37 *(Portuguese)*.

As a consequence of the frequent occurrence of shaft breakage, a project was initiated in 1979 for improvement in three sectors: complete revision of the material specifications, theoretical calculation of the stresses as a function of the configuration and work, and experimental measurement of actual stresses. The way in which these studies have been proceeding is described and illustrated, with an account of results to date and conclusions. Satisfactory results have been achieved only in respect of material; it has been concluded that steels to SAE-8640 or SAE-1045 specification are best. The theoretical calculation was performed using a 2-dimension finite element model which proved to be inadequate for an accurate stress determination. The problem calls for a 3-dimension model; however, a decision as to its development will depend on the results and conclusions of futher stress measurements. Data from the measurements yielded some understanding of the working stress behaviour but several questions remain unanswered and the process of gathering stress data will be continued.

Study of the stability of substances used in anti-scaling products

R. Rodríguez, E. León and X. Aguilar. *ATAC*, 1986, **45**, (2), 35 - 41 *(Spanish)*.

Disodium EDTA and sodium hexametaphosphate, both used to prevent or reduce scaling in evaporators, were disolved in model solutions of calcium chloride and in industrial cane juices; they were held for 20 minutes at temperatures of 25, 65 and 100°C and at pH 6.5, 7.8 and 8.0 in order to study their stability. Their complexing properties were found not to be affected by changes in pH and temperature but calcium hexametaphosphate was found at 100°C to form a colloid which altered the nature of the scale and assisted the descaling action of the chemicals used for cleaning.

1 Ramos *et al.*: *I.S.J.*, 1988, **90**, 51A.
2 Wright: *Proc. Australian Soc. Sugar Cane Tech.*, 1979, **1**, 161.

New design of BDM pan with mechanical circulation, Type TCF-45

Z. Pavonova, R. Corrales C. and J. Rodríguez G. *ATAC*, 1986, **45**, (2), 45 - 48 *(Spanish)*.

A vacuum pan with a mechanical stirrer was compared with an unstirred pan and the benefits of forced circulation of massecuite in relation to evaporation rate, steam economy, lack of false grain, etc., are described.

Bagasse drying. Comparison of drum dryers with flash-type dryers for their use in the sugar industry

J. Hernández F. *ATAC*, 1986, **45**, (2), 52 - 56 *(Spanish)*.

Drying of bagasse with flue gases permits an improvement of the steam balance of a sugar factory and a comparison has been made of two types of dryer for this purpose. The two types are described as are their operating principles, construction, power consumption, heat and mass transfer coefficients, loss of dried material to the atmosphere, flexibility of operation, precision of the moisture content of the exit material, volume of the installation and investment cost. The flash-type dryers appear to be more suited to uniform feed material in respect of particle size and flow rate and is recommended for small or medium scale plants. For larger-scale plants the drum dryer is preferable as it is more suited to variable particle size and flows.

Some problems in chemical control

D. P. Kulkarni. *Bharatiya Sugar*, 1987, **13**, (1), 9 - 11, 13 - 14.

Aims of chemical control in the sugar factory are discussed and shortcomings of the system as used in India are indicated; these include the need to replace indirect methods of determining the weight of imbibition water and of bagasse by direct weighing, improving the weighing accuracy of juice and allowing for extraneous matter when cane is weighed. The frequency of bagasse analysis should also be increased, while mixed juice should not be used as a basis for calculation of performance because of its lower purity by comparison with primary juice. Juice sampling should be continuous, while cane sampling is of no significance since payment is not based on quality. The Brix of molasses and products of high non-sugars content should not be measured by hydrometer, and polarimetry has been found to give erroneous results as a result of changes in the glucose:fructose ratio and/or the presence of dextran. Re-examination of formulae for milling and boiling house performances is needed. The role of the laboratory in chemical control is briefly examined.

Problems in chemical control

M. B. Bhonsle. *Bharatiya Sugar*, 1987, **13**, (1), 23, 25, 27 - 28.

Defects in the factory processes used in India are discussed; they include irregularity of crushing rates, wide variation in the imbibition rate, the need for good mill sanitation, sulphitation problems, excessive temperatures in juice heating and evaporation, the desirability of using continuous vacuum pans, vertical crystallizers and continuous centrifugals, and problems associated with water cooling. Problems found in chemical control are also briefly mentioned.

Problems in chemical control

R. K. Kulkarni. *Bharatiya Sugar*, 1987, **13**, (1), 41, 43, 45, 47 - 48.

Determining the weights of cane, imbibition water, bagasse, filter cake and final molasses as the first step in estimating factory performance and losses, sampling of cane and intermediate products, analysis, quality control, automatic control of pH and temperature in clarification, causes of losses and errors arising in pol balances are included in this discussion of chemical control.

A short note on the use of scale inhibitor Indion 8102

S. P. Kulkarni, P. C. Phansalkar, V. R. Burhse and R. K. Kulkarni. *Bharatiya Sugar*, 1987, **13**, (1), 121 - 122.

While Indion 81012 prevented scale formation in the 1st and 2nd evaporator effects at a sugar factory and ensured that the only scale in the 3rd and 4th effects was very soft and thin so that it was easy to remove, scale formation in the *A*-pans was greater than without use of the inhibitor and necessitated boiling-out every 4 - 5 days instead of the usual 9 - 10 days.

A study of exhaustion of final molasses

P. P. Chaturvedi. *Bharatiya Sugar*, 1987, **13**, (2), 9 - 11, 13 - 15, 17 - 18.

The chief causes of high molasses sugar contents and total sugar losses at Sonepat were found to be a high lime and ash content in raw juice and excessive lime addition in clarification. Details are given of remedial measures undertaken, including changes in massecuite boiling and curing; tabulated results show a definite improvement in molasses exhaustion as a consequence of the steps.

Pitting corrosion of stainless steels in sugar factory multiple-effect evaporators

R. Caro and R. Quintero. *Zuckerind.*, 1988, **113**, 231 - 234.

Investigations confirmed that cane juice can cause pitting of stainless steel tubes, the susceptibility to this form of corrosion increasing with Brix and hence with progress through the evaporator in the case of a multiple-effect unit. Pits already formed, e.g. by HCl solution used as descaling agent, grew larger in contact with juice; the use of other forms of descaling agent is recommended. The presence of molybdenum delays pit formation.

Beet sugar manufacture

On-line monitoring of pulp press water

R. Brophy. *Zuckerind.*, 1988, **113**, 141 - 142.

Continuous measurement of the pol of filtered press water at a US sugar factory is described. The sample is taken at the outlet of the pump recycling the water to the diffuser and flows via a stainless steel line to a filter comprising a piece of porous plastic and membrane filter material clamped between two steel plates within a housing; the juice flows through the filter at 20 litres/min and a pressure of approx. 2.8 bar (both rates depending on beet condition and temperature); any substance larger than 1.2 μm is blocked by the filter to yield a clear, turbidity-free filtrate, and the high flow rate helps to keep the filter surface clean. The filtrate is collected in a tank whence it passes through the tube of a Crystal Tek International CTI 501 computerized dark-solution polarimeter. The readings are displayed as °S, % sugar, angle of rotation or absorbance. Although the system is not reliable as an absolute indicator of pulp losses, as demonstrated by differences between the pol readings and laboratory measurements, it is of value in indicating trends. The filter needs cleaning every 2 weeks.

Investigation and development of a system for industrial continuous crystallization of sucrose. VII. Comparative dimensional analysis of batch and continuous crystallization systems for white sugar manufacture by a 3-stage crystallization scheme

V. Sinobad. *Ind. Secera*, 1986, (1 - 2), 7 - 11; through *S.I.A.*, 1988, **50**, Abs. 88-89.

Dimensions of equipment for operating these systems were calculated, using models of a continuous vacuum pan developed previously. All data were calculated for a factory producing 1000 tonnes of standard quality sugar/day from 2350 tonnes of beet containing 17.5% sucrose. Results showed that the total volume of batch equipment for the 1st boiling would be 2.1 times that of a continuous pan of the same capacity; the volumes of batch pans and crystallizers for the 2nd boiling would be 1.5 times that of continuous equipment, and for the 3rd boiling (assuming 36 hr in the crystallizers) they would be twice as large. The implementation of continuous 3-stage boiling in the Yugoslav sugar industry is recommended.

Experience in using vertical crystallizers for additional crystallization of the final (C) syrups in the "Kristal" sugar factory at Senta

P. Terzic and J. Posa. *Ind. Secera*, 1986, (1 - 2), 24 - 32; through *S.I.A.*, 1988, **50**, Abs. 88-90.

The plant for crystallization of *C*-massecuite at Senta was extended by adding two vertical crystallizers to the existing horizontal ones, thus prolonging the crystallization time from 27.3 hr in 1983/84 to 58.8 hr in 1985/86. Results of tests are tabulated. Unexpectedly, the longer crystallization time did not improve molasses exhaustion; average molasses purity was identical (59.83) in both campaigns. Further optimization of the crystallization process is obviously needed.

Effects of syrup washing on the material balance of sugar crystallization

M. Masirevic. *Ind. Secera*, 1986, (1 - 2), 37 - 41; through *S.I.A.*, 1988, Abs. 88-92.

Washing of sugar during centrifuging is usually carried out with water or steam, but the sugar yield can be increased by washing with syrup. This method leads to a decrease in the quantity and purity of run-off syrup. Detailed material balances are shown for two variations of a 3-boiling scheme. The first is a typical scheme as used at Zrenjanin factory; in the second, instead of a minor part of the *A*-syrup being recirculated, it is used to wash the *B*-sugar, and much less wash water is used for the *A*- and *B*-sugars. Data are given on the beneficial effects which would be obtained in a factory processing 4500 tonnes of beet/day.

An automated system for determination of the quality and payment of sugar beet

N. Lambrev and N. Popov. *Khranitel-noprom. Nauka*, 1987, **3**, (7), 37 - 40; through *Ref. Zhurn. AN SSSR (Khim.)*, 1988, (4), Abs. 4 R512.

An automatic system has been developed to determine the quality and payment of sugar beet based on the use of a IZOT 1031S personal computer. Introduction of the system will allow rapid and accurate processing of data for determination of beet quality and immediate communication of the information to interested bodies.

Microbiological processes in sugar beet storage

K. Hangyál. *Cukoripar*, 1988, **41**, 7 - 9 *(Hungarian)*.

A survey, with 23 references to the literature, is presented of the microbiology of beet storage, including the species of fungi that occur and the conditions that are essential for their activity, the extent of damage and losses they may cause, the reaction of the beets to fungal attack and conditions under which they are more susceptible, the possible spread of infection and chemical control methods.

Sugar drying and cooling in a rotary drum at Petohaza sugar factory

M. Tömördi. *Cukoripar*, 1988, **41**, 10 - 15 *(Hungarian)*.

Details are given of a rotary drum granulator built in Hungary as a special piece of equipment and installed at Petohaza for the 1985/86 campaign. Designed for an hourly throughput of 30 tonnes of sugar, the drum rotates at 4.17 rpm; drying air passes through a shell-and-tube heater before entering the drum and

flowing co-current with the moist sugar. As the drum rotates, the sugar lying on the bottom is picked up by special elongated scoops attached to the inside wall and trickles down as the angle of repose steepens. The moisture content of the dried sugar in 1986/87 averaged 0.033%. Details are given of the average grain size distribution, colour and ash content of the sugar, which has proved suitable for silo storage.

Changes in certain properties of sugar beet during storage

K. Vukov. *Cukoripar*, 1988, **41**, 17 - 23 *(Hungarian)*.

Knowledge on the general trends in changes that occur in beet composition after harvest and those changes taking place during storage in field clamps and during longer-term storage in piles is summarized with 40 references to the literature covering sugar, invert sugar, raffinose and kestose, nitrogenous compounds, inorganic matter, organic non-N substances, insolubles (such as pentosans, pectins, cellulose, lignin and raw protein), tissue permeability and marc content. Tabulated data are presented in many cases.

A market survey of batch sugar centrifugals

Anon. *Zuckerind.*, 1988, **113**, 195 - 200, 202 *(English, German)*.

Details are given in tabulated form of batch centrifugals manufactured by nine European manufacturers, including: field of application; basic design; dimensions without motor; basket dimensions, material, number of hoops and perforations; standards to which the machines are built; type of bottom valve; total screen area; working and backing screen recommendations; speed; average number and weight of massecuite charges per hour; power consumption; accessories; motor recommendations; vibration control; and special features. The addresses of the manufacturers are also provided.

High-performance screening machines with electromagnetic drive for white sugar

H. Schröder. *Zuckerind.*, 1988, **113**, 218 - 221 *(German)*.

Details are given of the electromagnetic vibratory screens installed at a sugar factory where the requirements were for increased hourly throughput (100 - 120 as against 50 - 55 tonnes with the old system) without any change in the building space and conveying plant. Reasons are given for the choice of screens. The new system comprises two double-decker units each for Grade 1 and Grade 2 white sugar, with all four units connected to a central dust separator. The desired sugar classification was achieved soon after installation of the screens and maintained throughout the campaign.

Processing rhizomania-infected sugar beet

L. Bozhkov, N. Lambrev, N. Marinova, P. Georgieva and L. Khristova. *Nauchn. Tr. Vissh. Inst. Khranit. Vkus. Prom.*, 1986, **33**, (2), 109 - 115; through *Ref. Zhurn. AN SSSR (Khim.)*, 1988, (6), Abs. 6 R486.

Results are given of studies on the composition of rhizomania-affected sugar beet and of laboratory purification of raw juice obtained from it; it was found that such beet may be processed when mixed with healthy beet but should not be processed at all if 70% or more of the roots are diseased.

Possibilities of using dextranase derived from *Penicillium wortmannii* in sugar manufacture

Ya. Popova, N. Lambrev, S. Angelova, S. Glukharev and N. Tien. *Khranit. Prom. Nauka*, 1987, **3**, (6), 83 - 86; through *Ref. Zhurn. AN SSSR (Khim.)*, 1988, (6), Abs. 6 R488.

The effect of pH, temperature and duration on the stability of dextranase obtained from *P. wortmannii* was studied with the aim of using it to degrade dextran present in raw juice. It was found that at 50 - 60°C and pH 5.0 - 6.5, dextranase acted for 15 min. Treating raw juice with the enzyme (in the form of a filtered liquid culture) at 75 units/dm^3 at 60°C for 10 min reduced the coefficient of filtration by 70%.

Optimum massecuite boiling

M. A. Karagodin. *Period. Polytechn. Chem. Eng.*, 1987, **31**, (3), 161 - 167; through *Ref. Zhurn. AN SSSR (Khim.)*, 1988, (6), Abs. 6 491.

The most important aspects of the boiling process are examined: vacuum pan design, calandria arrangement and heating surface area, syrup feed rate and other factors having a substantial effect on the course of the process. One means of technologically optimizing boiling is the use of crystal footing containing crystals of 0.2 - 0.3 mm at an optimum distance from one another. It is recommended to boil on syrups of high Brix (70 - 75°) prepared in special pre-concentrators. Application of the proposed methods together with reliable control and measuring instruments for the basic process parameters improves boiling in any type of pan.

The structure of a mathematical model of the sucrose crystallization process

M. A. Karagodin. *Period. Polytechn. Chem. Eng.*, 1987, **31**, (3), 169 - 177; through *Ref. Zhurn. AN SSSR (Khim.)*, 1988, (6), Abs. 6 R494.

A mathematical model presented of the pan boiling process was developed at the Food Industry Technological Institute in Moscow from an analysis of results achieved world-wide and from experimental data. The structure of the model is given and the mathematical relationships incorporated in it and reflecting the interaction of the basic process parameters are defined. The model may be used for computerized simulation of the boiling process and for quantitative and qualitative calculations.

Laboratory studies

Influence of iso-maltose and other sugars on the crystal habit of sucrose

M. López, E. L. Ramos and J. V. Hormaza. *CubaAzúcar*, 1986, (Jan.-March), 38 - 42 *(Spanish)*.

The mixture of sugars produced by hydrolysis of dextran was shown not to deform the sucrose crystal. While iso-maltose in high concentration produced a small effect on the crystal habit, the concentrations encountered in sugar factory products would not be expected to have any appreciable effect.

Use of high performance liquid chromatography (HPLC)

C. O. Mariano and J. F. Silva, Jr. *Bol. Técn. Copersucar*, 1986, (34/86), 20 - 21 *(Portuguese)*.

An account is given of the HPLC equipment in use at the Copersucar Technology Centre for analysis of sugars in sugar factory and distillery materials, with illustrations of chromatograms and a note of research under way with its use.

Microscopic control of the process of alcoholic fermentation

J. Finguerut, H. A. Lucredi, K. H. Leimer and C. E. V. Rossell. *Bol. Técn. Copersucar*, 1986, (34/86), 22 - 26 *(Portuguese)*.

Dead yeast cells are stained with methylene blue in a new technique for determining the viability of yeast samples, and an acount is given of its use at two cane sugar factory/distilleries.

Determination of herbicide residues in beet sugar

P. Farkas and J. Tekel. *Sb. UVTIZ, Potravinarske Vedy*, 1986, **4**, (2), 129 - 134; through *S.I.A.*, 1988, **50**, Abs. 88-149.

Two methods were developed for determination of residues of the herbicides atrazine, lenacil and chloridazone in sugar. One involved capillary GC with an NP-selective detector, while the other involved TLC with selective determination of the herbicides by the inhibition of Hill's reaction. Samples of sugar fortified with 0.01 or 0.005 ppm of one of the herb-icides were analysed. Recovery was about 90% for atrazine and lenacil and about 60% for chloridazone. Analysis of commercial beet sugar from the 1984 campaign showed it to contain 0.003 ppm atrazine, not more than 0.001 ppm lenacil and 0.001 ppm chloridazone. The two methods gave similar results, and the choice of method depends on the laboratory equipment available.

Trace analysis of sugars by HPLC and post-column derivatization

H. Engelhardt and P. Ohs. *Chromatographia*, 1987, **23**, (9), 657 - 662; through *Anal. Abs.*, 1988, **50**, Abs. 3C11.

Sugars, e.g. arabinose, glucose, fructose (each 80 ng), raffinose and sucrose (each 160 ng), were separated at 36°C on a column containing the strongly basic anion exchange resin HPIC-AS6 (Dionex) with 0.15M NaOH as mobile phase (0.5 ml/min). The eluate was treated with 0.2% thymol in concentrated sulphuric acid in a specially designed reaction coil operated at >90°C. Detection was at 500 nm. Results are presented for 17 sugars.

Assay of reducing sugars in the nanomole range with 2,2'-bicinchoninate

S. Waffenschmidt and L. Jaenicke. *Anal. Biochem.*, 1987, **165**, (2), 337 - 340; through *Anal. Abs.*, 1988, **50**, Abs. 3D172.

Reducing monosaccharides were determined by using L-serine and 2,2'-bicinchoninate as chelating agents for Cu (II) and Cu (I), respectively. The samples (<25 nmole of sugar) were mixed with reagent solution (aqueous disodium 2,2'-bicinchoninate : sodium carbonate : sodium bicarbonate mixed with aqueous copper sulphate : L-serine) and kept for 15 min at 100°C; after cooling to room temperature over 20 min, the absorbance of the solution was measured at 560 nm. The response was rectilinear for <25 nmole of sugar per sample; borate, phosphate or other buffer ions did not interfere. The extinction coefficient values of the Cu (I) chelate obtained with 12 different monosaccharides are tabulated.

Modelling crystallization and inclusion formation in sucrose crystals

M. Saska. *Zuckerind.*, 1988, **113**, 224 - 229.

A model of growth and formation of inclusions in the sucrose crystal allowed for the effects of stirring rate, face crystallography and anisotropy of the crystal surface; the system consisted of a crystal (with or without liquid inclusions), interface between the solid and liquid phases, a fluid film around the crystal where mass transfer was a result of molecular diffusion only, and the bulk of the fluid of uniform concentration. A set of conditions was selected that would be of interest for white sugar boiling: a temperature of 70°C, supersaturation of 1 - 30% and circulation rates of 0.1, 1.0 and 10.0 cm/sec. The results obtained were in qualitative agreement with those of Mantovani *et al.*[1] and Guo & White[2]. Although the dissolution-growth cycle that occurs in boiling as a result of periodical passage of crystals through zones of high and low temperature and/or periodical dilution is a factor of major importance, it was not considered in the experiments and is, in any case, regarded as avoidable.

Alternative methods of polarizing sugar

C. C. Chou. *Sugar J.*, 1988, **50**, (9), 4 - 10.

See *I.S.J.*, 1988, **90**, 8A.

1 *Paper presented at Meeting of Amer. Soc. Sugar Beet Tech.*, 1985.
2 *I.S.J.*, 1985, 87, 53A.

By-products

Continuous ethanol fermentation by immobilized yeast cells

R. B. Natu, P. S. Shinde, C. S. Shinde, S. V. Patil and S. J. Jadhav. *Bharatiya Sugar*, 1987, **13**, (1), 115, 117, 119 - 120.

Methods of immobilizing yeast cells for continuous alcohol fermentation are examined, including adsorption, entrapment and covalent coupling, and an account is given of work at the Deccan Sugar Institute in which entrapment in calcium alginate beads prepared from Na alginate and Ca chloride gave promising results in maintaining the fermentation of pre-centrifuged and pre-sterilized dilute molasses for about 200 days in a 13-litre column at an approximate flow rate of 500 - 600 ml/hr (a retention of approx. 15 - 18 hr). The fermented wash contained 6.5 - 7.5% alcohol.

Bacillus spp. in sugar cane fermentation media

B. Ganou-Parfait, L. Fahrasmane and A. Parfait. *Belgian J. Food Chem. Biotechnol.*, 1987, **42**, 192 - 194.

Three *Bacillus* spp. were found in cane juice used as fermentation medium for the production of rum, namely *B. subtilis*, *B. megaterium* and *B. sphaericus*; *B. cereus* was found only in milled cane before the occurrence of anaerobiosis. The main properties of the first three species are tabulated; all were found capable of producing small-chain volatile fatty acids and higher alcohols, but more important than this was their ability to consume fairly large quantities of alcohol (although it is not certain that these micro-organisms alone are the sole cause of a low efficiency found in rum production).

Beet alcohol in France from 1914 to 1987

P. Girault. *Sucr. Franç.*, 1988, **129**, 5 - 20 *(French)*.

An account is presented of alcohol production from sugar beet and molasses in France from 1914 to 1987, including regulations governing the manufacture, marketing and use of alcohol.

Ethanol and fuels

J. Cuel. *Sucr. Franç.*, 1988, **129**, 21 - 29 *(French)*.

The use of alcohol as a motor fuel in a mixture with gasoline is discussed. Its chief advantages mentioned include the absence of lead, its contribution to a higher octane rating and the renewability of its source (sugar beet); moreover, it would be of benefit to switch from sugar production to alcohol manufacture in view of the over-production of sugar within the EEC. Other aspects discussed include the energy balance of alcohol production from sugar, the relative production costs of alcohol and gasoline, and how to bridge the gap between the two. While fermentation alcohol is the more expensive product, the possibility of using treated vinasse as animal fodder would allow reduction of feedstuffs imported into France.

Sucrose esters in preservation of fruits and eggs

T. G. Kolekar, H. M. Modak and S. J. Jadhav. *Bharatiya Sugar*, 1987, **13**, (2), 25, 27 - 28.

A surface coating of a mixture of sucrose stearates containing a preponderance of monoester was found to delay the ripening and hence deterioration of bananas and mangoes and increased the shelf life of eggs.

Feasibility of mini pulp plants

J. R. Zegarra. *GEPLACEA Bull.*, 1988, **5**, (2), 10 pp.

While bagasse pulp has traditionally been used in Mexico for the manufacture of writing and printing paper, toilet and facial tissues and corrugated cardboard, the author is of the opinion that it should also be used for the production of lineboard, Bristol board, paper for bags and sacks as well as crepe and wrapping paper as in other countries; this requires a semi-chemical pulp for which reagent consumption is lower but the pulp yield must be higher than pulp produced for bleaching. However, a large pulp plant needs all the bagasse from more than one sugar factory, which entails using an alternative fuel as well as creating problems and raising the costs involved in transport over greater distances. Reference is made to investigations conducted by various authors on the feasibility of producing bagasse pulp in mini-plants of 15 - 70 tonnes daily capacity (dry bagasse), and processes suitable for use in such plants are indicated as well as the costs involved. Six factors of major importance are listed that govern the feasibility of mini-plant operation.

Obtaining biogas from distillery vinasse

V. Goslich and L. Schneider. *Branntweinwirtsch.*, 1987, **127**, (3), 30 - 35; through *S.I.A.*, 1988, **50**, Abs. 88-195.

Tests were carried out in a pilot reactor of about 2 m^3 volume on the degradation of COD in vinasse from beet molasses and simultaneous production of biogas. The system was operated under different sets of conditions: a fixed-bed reactor with one or two stages, or a completely mixed reactor with sludge recycling, either in two stages or by means of a membrane filter. The vinasse contained 70.7 g total COD/litre and 5.1 g sulphate/litre. The one-stage process first tested was not successful, nor was retention of biomass by the membrane filter. By separating the process into a hydrolysis stage and methanogenesis stage and especially by reduction of sulphate obtained in the 1st stage, a substrate containing up to 2.4 g sulphate/dm^3 could be processed. Up to 80% degradation of COD was achieved. Tests are continuing on ways of increasing the loading achievable per unit volume. From 1 m^3 vinasse was obtained up to 20 m^3 methane with a heating value equal to 20 dm^3 of heating oil. However, the biogas also contained about 1% H_2S. To obtain a higher % degradation of COD, the effluent will require aerobic treatment after the anaerobic process.

Hydrolysis of sugar cane bagasse with hydrochloric acid, promoted by ultrasound

U. Schuchardt, I. Joekes and H. C. Duarte. *J. Chem. Technol. Biotechnol.*, 1987, **39**, (2), 15 - 124; through *S.I.A.*, 1988, **50**, Abs. 88-226.

The effect of ultrasound on the hydrolysis of prehydrolysed bagasse by HCl at various concentrations (36 - 41%) was investigated. Ultrasound promoted the hydrolysis only when an intermediate HCl concentration (38%) was used. The lowest frequency tested (25 kHz) was more effective than 35 or 40 kHz. Ultrasound enhanced the promoting effect of lithium chloride, but at the lowest frequency the reducing sugars were re-oligomerized; at higher frequencies, higher LiCl concentrations were needed for complete conversion.

Sequential acid and enzymatic hydrolysis of sugar beet pulp

G. Schaffeld, A. Illanes, G. Mejias and A. M. Pinochet. *J. Chem. Technol. Biotechnol.*, 1987, **39**, (3), 161 - 171; through *Ref. Zhurn. AN SSSR (Khim.)*, 1988, (4), Abs. 4 R434.

Investigations were carried out to determine optimum conditions of hydrolysis in an acid medium (for maximum degradation of hemicellulose without cellulose degradation) and of enzymatic hydrolysis of the residual cellulose that is responsible for saccharification. Results showed that two-stage hydrolysis permits sugars to be obtained from beet pulp that are subject to the action of enzymes. In the first stage (treatment in a weakly acid medium), hemicellulose is hydrolysed to yield a syrup of high pentose content and a high-cellulose fraction. In the second stage, this fraction is subjected to saccharification by enzymes, particularly fungal cellulases, to yield a high-glucose syrup. The effects of the times of the reactions, the quantitative ratio of enzymes to substrate and the particle size of the pulp on enzymatic hydrolysis were studied. The saccharification rate and the degree of conversion to glucose depend to a great extent on the ratio between the enzymes and the substrate. The following are presented: a 2-stage scheme for enzymatic hydrolysis of beet pulp; graphs of the relationship between hydrolysis rate and time at 60° and 80°C and various concentrations of hydrochloric and sulphuric acid; the degrees of cellulose saccharification and of enzyme activity as a function of time at different enzyme:substrate ratios and pulp particle sizes, and the rates of fall in concentration of the sugars as a function of time during anaerobic treatment with *Saccharomyces cerevisiae* ATCC 4126.

Studies on the conversion of cellulose hydrolysate to citric acid by *Aspergillus niger*

H. K. Manonmani and K. R. Sreekantiah. *Process Biochem.*, 1987, **22**, (3), 92 - 94; through *Ref. Zhurn. AN SSSR (Khim.)*, 1988, (4), Abs. 4 R443.

An investigation was conducted on biosynthesis of citric acid (I) by *A. niger* cultured on bagasse hydrolysate. Optimum composition of the culture medium was: sugar 7%, sodium nitrate 400 mg N_2/litre of medium, KH_2PO_4 0.1% per litre, ethanol 3%, fluoroacetate 1×10^{-2} M and coconut oil 3%. Maximum citric acid accumulation in the culture liquid occurred after 72 hr.

The effect of certain factors on low-temperature drying of beet pulp

I. Dimitrov. *Khranitelnoprom. Nauka*, 1987, **3**, (7), 53 - 56; through *Ref. Zhurn. AN SSSR (Khim.)*, 1988, (4), Abs. 4 R537.

A mathematical model is presented of the relationship between the major factors affecting low-temperature drying of beet pulp. The effect is shown of the effect of temperature of the drying agent (optimum 70 - 80°C) and of the thickness of the bed of pulp on the degree of drying and on the process time.

Preparation of chemi-mechanical bagasse pulp for newsprint

W. F. Yee, H. C. Huang, W. C. Hsieh and L. H. Wang. *Taiwan Sugar*, 1987, **34**, (6), 18 - 23.

See *I.S.J.*, 1988, **90**, 85A.

Molassed sugar beet feed-based compound feeds for pregnant and lactating ewes

G. Fishwick and G. Hemingway. *British Sugar Beet Rev.*, 1988, **56**, (1), 70 - 71.

Results of tests in which lactating ewes with twin lambs were fed on rations containing 70% or 75% molassed beet pulp showed there was no essential difference in mean liveweights and body conditions by comparison with feeding on dairy compound feeds or a barley concentrate; it is important to provide adequate and appropriate protein and mineral/vitamin supplements in the diets.

Product news

Cane by-products utilization company

Tritech Capital Inc. has acquired the stock of GW Technologies Inc. (GWT), a Louisiana biotechnology company specializing in the conversion of agricultural waste into a variety of soil conditioning and fertilizer products. GWT's waste conversion process has been found to be particularly applicable in the cane sugar and alcohol sectors; it successfully neutralizes distillery effluent and combines it with sugar factory waste to produce a biological soil conditioning and fertilizing agent of high economic value. The only by-product of the process is agricultural grade water suitable for irrigation.

A 1.5-tonne pilot plant is in operation in Venezuela and a full-scale plant is expected to be erected by the end of the year. The company plans to build plant modules capable of producing 50,000 tonnes a year of fertilizer and soil conditioner in a number of countries; its 5-year plan calls for 50 such plants and this is considered conservative in view of the scope of the problem and the growing importance of waste management.

The technology grew out of research by Dr. Gordon Williams, a microbiologist and former scientist with the Battelle company. He and Graeme Westbrook, President of Tritech, found a suitable base in Louisiana where the technology could be commercialized. They have developed a strong support base, with F. C. Schaffer & Associates Inc., M. A. Patout & Sons (owners of Enterprise sugar factory) as affiliates and have also developed a working relationship with the Audubon Sugar Institute of Louisiana State University where GWT is continuing research and development.

Dr. Williams' process is a bacterial fermentation that uses a naturally occurring culture that breaks down toxic materials in the effluents and converts them into a fertilizer in which trace elements are captured and nitrogen is fixed in such a way that the soil "matrix" is enhanced. It eliminates the expense and difficulty of disposing of vinasse, while requiring only a quarter of the energy required in producing the equivalent amount of chemical fertilizer. It is not intended to replace chemical fertilizer, however; indeed, three-year crop studies have shown that GWT's "biomass" product in combination with chemical fertilizer is better than either product used alone.

GWT will seek joint ventures with regional or national partners, or through a private client relationship or as a participant with a government in a licensing arrangement. The company is currently assisting the US Agency for International Development in the Caribbean with an overall enhancement program for the sugar industry in St. Kitts.

Molasses additive increases fluidity, reduces foaming and stickiness

An additive that increases fluidity and reduces the foaming and stickiness of molasses has been introduced by Hodag Corporation. In addition to listing the typical properties of the product, Hodag FLO-1, Bulletin R 22-769 covers its application in clarifying molasses for fermentation, blending of molasses into dry animal feeds as well as where, how and how much to use in its diverse applications.

Hodag FLO-1 is sanctioned by the US Food & Drug Administration for use at up to 320 parts per million. It has proved to perform effectively in pumping, transporting and storing molasses, and may be added to facilitate loading and unloading at the sugar factory. At marine terminals, the elimination of foam and entrained air, which it permits, substantially increases the capacity of shipboard holding tanks.

The change in thixotropic character of molasses, and increasing its fluidity, will increase the capacity of filters and centrifugals. More sludge and colloidal impurities can be removed and more efficient heat exchange and sterilization of the molasses will result. Other effects reported by Hodag include the reduction of scale on heat exchange surfaces, easier to clean lines and equipment as well as economies through reduction in down-time, labour and chemicals.

Bulletin R22-769 points out the improved handling of molasses in its blend with FLO-1 in dry animal feed, as higher concentrations can be incorporated without balling and sticking. The increased fluidity and prevention of foaming permits faster pumping and blending.

Copies of the bulletin are available from the Hodag Corporation, 7247 N. Central Park Avenue, Skokie, IL 60076, USA. Hodag laboratory services and sample product batches are also available upon request.

Better buckets, fewer holes?

Everwear conveyor buckets are proven to outlast steel, nylon and plastic by at least 10 times and, made of tough Rhino Hyde polyurethane with only half the weight of steel buckets, they easily handle sugar, fertilizers, cement, coal, detergents, silica, sand, gravel, wood chips, etc.

Tandem's Ultraslide buckets are made of high performance polyethylene. These lightweight buckets stand up to abrasion and corrosion. They are available in three types (1) standard high speed, (2) high capacity low profile, and (3) heavy duty industrial.

Further details:

Tandem Products Inc,
520 Industrial Drive,
Blooming Prairie, MN 55917,
USA.

Continuous K 1500 DS centrifugal

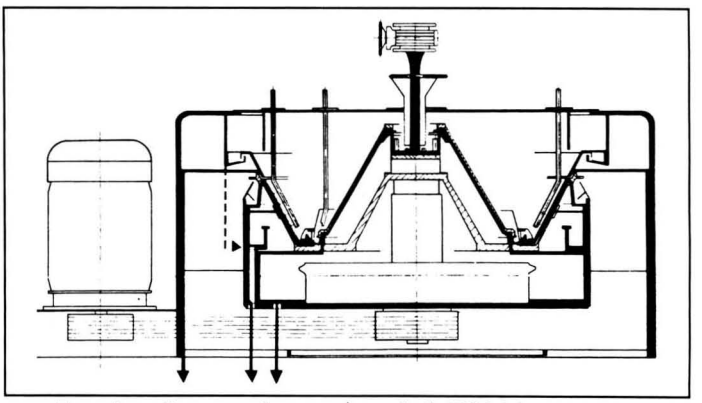
The K 1500 DS (DS = double spinning) developed by BMA for continuous handling of high-purity beet or cane massecuites and to produce sugar of a quality which in respect of wash water requirements, syrup separation, and sugar yield comes up to that

produced in batch centrifugals.

As against conventional continuous centrifugals, the K 1500 DS machine has a screened acceleration stage for green syrup separation, a sugar/syrup magmatizing facility, and a device preventing re-contamination of the washed sugar.

Owing to the fact there is exact separation of syrups in the K 1500 DS, syrup can be applied either in the magmatizing facility or, through nozzles, in the washing stage. The effect is that wash water requirements are reduced, and crystal yield is increased in a manner comparable to that in batch centrifugals.

Developments of the K 1500 DS proceeded in a number of successive steps. It was relatively easy to reach a point where, at a good processing rate, sugar quality and syrup separation bore comparison with batch sugar centrifugals. It proved to be rather difficult, however, to draw level with respect to wash water requirements and crystal sugar yield.



For an immediate comparison, tests were made in a sugar factory on a K 1500 DS and an existing 1000 kg batch centrifugal, the feed being high-raw massecuite. Setting and operation not only of the K 1500 DS but also of the batch machine used for comparison were an optimum. The reference machine had a syrup separating device and a fully perforated basket meeting latest standards. Thick juice was used as wash liquid and condensate for melting.

The table is a summary of representative results of the tests: They confirm that the characteristics of the K 1500 DS compare very well with those of a batch centrifugal. The tests, on the other hand, also revealed that the K 1500 DS responds far more sensitively to any fluctuations in the quality of the massecuite .

While the K 1500 DS handles even poor massecuites at the normal rate and still produces very good results, the basket filling/charge of the batch centrifugal in some instances has to be reduced to 70% of rated capacity, and the syrup and water wash have to be changed in order to produce the intended sugar quality.

As only minor constructional changes are involved, the operating and maintenance costs of a K 1500 DS are no higher than those of a conventional continuous centrifugal. For specific duties, the K 1500 DS can be furnished with either a melting facility (K 1500 DSA) or a magmatizing facility (K 1500 DSM). The K 1500 DSA produces liquor inside the centrifugal, the K 1500 DSM provides for magmatizing of the spun sugar within the centrifugal.

For several seasons already, continuous K 1500 DS centrifugals have successfully been in operation in the beet sugar industry where they are employed for high-raw massecuite. The

Test period	First week		Second week	
Centrifugal	K 1500 DS	Batch machine	K 1500 DS	Batch machine
Massecuite:				
Dry matter, %	93.4		92.6	
Pol, %	83.5		81.73	
Purity, %	89.4		88.25	
Ash, %			3.37	
Processing rate, tonnes/hr	20	9.1†	20	9.1†
Water requirement, % on massecuites	2.75	3	2.5	3
Green syrup:				
Dry matter, %	85	*	85.1	*
Pol, %	64.55	*	62.6	*
Purity, %	76	*	73.6	*
Wash syrup:				
Dry matter, %	75.6	*	78.0	*
Pol, %	66.6	*	66.56	*
Purity, %	88.17	*	85.36	*
Liquor:				
Ash, %	0.086	0.072	0.118	0.116
Colour (ICUMSA, 560 mm)	53	55	120	133
Crystal yield, % on massecuite	52.3	*	53.2	51.9

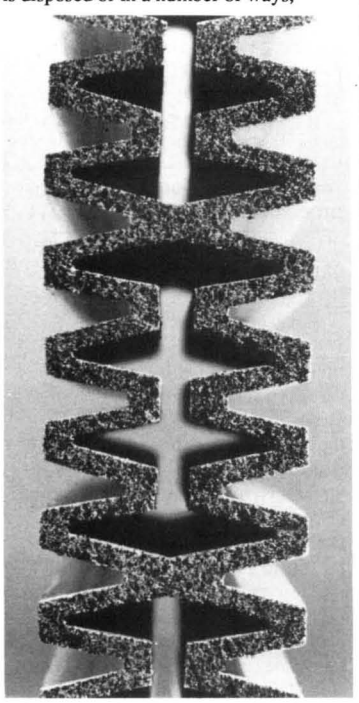
* not measured
† 13 charges/hr, basket filled 70%

new K 1500 DS is a genuine alternative to batch machines for many applications.

Sintamatic filters for dust control

Sintamatic filtration offers an extremely high level of efficiency and gives three times more surface filtration utilizing the same area of a conventional fabric filter. Comprising a patented blend of granulated engineering polymers, the Sintamatic composite materials are "baked" or sintered, until they form a rigid, porous composite element. Maximum filtration properties are ensured by coating the element with a PTFE based solution which permeates into the composite surface and is impervious to dust particles allowing through the filter only clean air.

A reverse-jet air cleaning system removes any dust that gathers on the resistant coating and this ensures efficient running performance. The dust is disposed of in a number of ways, including hoppers to screw conveyors, which can mean recycling back into the manufacturing process if required.



Cross section through a Sintamatic filter element

The revolutionary Sintamatic filter elements are both inert and dimensionally highly stable, as well as extremely burst- and wear-resistant. This high level of filtration performance is reinforced by DCE's three year guarantee, ensuring that the filter element is maintenance free and production processes can remain continuous.

Sintamatic filters are more compact than fabric filter collectors of equivalent capacity and can fit directly onto a purpose built storage container or can be integrated in the process. The units can be constructed using high grade stainless steel components to give additional benefits of resistance to corrosion and erosion for use in clean and difficult environments.

Sintamatic units are ideal for filtration in application where powdered and granulated materials such as sugar are handled and processed or for use where there is machinery which generates dust.

Further details:

DCE Group Limited,
Humberstone Lane,
Thurmaston,
Leicester LE4 8HP,
England.

Viscosity control for vacuum pans

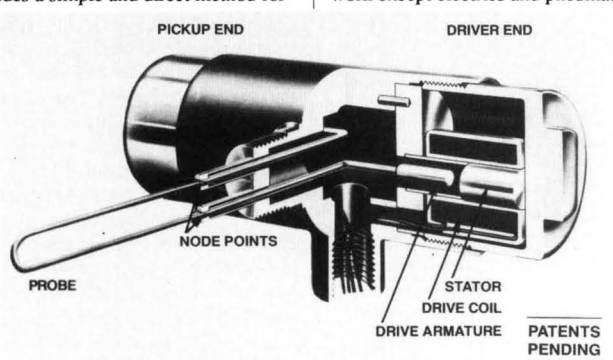
The Dynatrol viscosity system provides a simple and direct method for measuring massecuite consistency in vacuum pans. It operates by detection of changes in the amplitude of vibration of a probe excited at a frequency of 120 Hz by a pulsating magnetic field. The amplitude is converted to a 4 - 20 mA D.C. signal. Temperature compensation is achieved through use of a temperature-sensitive resistance probe installed in the process and temperature compensating circuitry in the converter. The Dynatrol is installed under the calandria for continuous measurement of consistency. It is described in a new brochure, Bulletin J-64VA, obtainable from:

Automation Products Inc.,
303 Max Roy Street,
Houston, TX 77008, U.S.A.

Bulk outloading improvements at Wissington

Bulk outloading at British Sugar's Wissington plant has been streamlined for the 1988/89 campaign, following £300,000 worth of improvements by handling technology specialist Geo. Robson & Co. (Conveyors) Ltd., of Coleford Road, Sheffield S9 5PA, England.

Robson has doubled the capacity of bunkers feeding granulated sugar into road tankers, increased under-cover accommodation for tankers during loading and eliminated an overlap in loading areas for bulk sugar and 50-kg bags. As sole contractor, the company was responsible for all aspects of the work except electrics and pneumatics,



which were handled by British Sugar's own engineers.

Enlargement of three bunkers has increased the capacity of each from 20 to 40 tonnes. It has also entailed considerable modification of existing handling plant, since the bunkers are now 2.6 m higher than the old floor level. The bunkers were previously fed by two steel band conveyors, bringing in sugar from production and from the storage silos. Both band conveyors have been shortened and the first now feeds sugar from storage into a non-spill trough conveyor which discharges into the bunkers from a triple outlet screw conveyor.

The second band conveyor now receives production sugar en route for storage via a new, raised screw conveyor – also with triple discharges – which passes over the top of the bunkers. Sugar can be fed into each of the bunkers by means of pneumatic slide valves in each outlet. The new conveyors have an hourly capacity of 70 tonnes.

To accommodate the new level of the bunkers and handling plant, Robson had to break out the old concrete floor, install new steelwork, raise the roof by 3 metres and install a new mezzanine floor over the top of the bunkers. In the bulk tanker loading area below, Robson has improved weather protection by installing a 5 metre-deep canopy which also extends over the adjacent bagging plant loading bay.

In this bay, 50 kg bags of sugar are now moved out to waiting lorries on an extending belt conveyor. The conveyor is reversible, and can be positioned to carry bags out to the lorries, or into storage on the other side of the bay. It is fed by one of two 90° curved gravity rollers which receive bags from the existing line in the bagging plant. The new system eliminates the problem of bag loading occupying space beneath one of the bulk loading bunkers.

To complete the contract, Robson has also extended the existing warehouse to create a larger under-cover area for lorry loading. All work was completed by the beginning of May 1988, and storage sugar was passing through the first part of the system within five weeks of commencing on site – one week ahead of schedule. Robson were previously on site at Wissington in 1987, installing a £200,000 stainless steel screw conveyor system which increased pressed pulp throughput to allow processing of 12,000 tonnes of sugar beet per day.

Cake washing in solid/liquid separation

To recover sugar from the filter-cake separated from juice in sugar factories requires washing. There are two ways of doing this: displacement washing of the cake on the filter, and washing by repulping the cake and re-filtering. To save wash liquid counter-current washing is often used. Control of washing is reasonably easy and fairly good washing efficiency is obtained. However, wash water consumption is often very high, resulting in too much dilution of filtrate.

The essential feature for maximum washing efficiency is that replacement by wash water of the juice retained in the filter cake must be as complete as possible. This is achieved in the automatic pressure filters made by Larox Oy., of Finland, in which the initial filtration stage is followed by diaphragm pressing at up to 16 bar pressure. This ensures that the cake has (1) a very low residual moisture content and that (2) there is an empty space between the rubber diaphragm and the cake surface. This empty space is filled with wash water which is then forced through the cake by diaphragm pressing. Because the diaphragm presses uniformly across the cake surface the liquid contained in the cake is uniformly displaced.

The Larox filter comes very close to achieving the highest theoretical washing efficiency, because diaphragm pressing gives almost complete displacement of entrained liquid in cake. In theory the Larox pressure filter achieves 50 - 60% better washing efficiency than a vacuum filter. In practice this is higher because of the true displacement wash feature of the Larox unit.

A second washing stage will give an over 99% washing efficiency, but more wash liquid is required. This problem can be overcome by counter-current washing whereby the wash filtrate from the second wash becomes the wash liquid for the first wash. By the addition of two valves to the Larox PF filter, two-stage counter-current washing can be achieved, giving a higher washing efficiency than any other washing system, low wash liquid consumption resulting in reduced recirculating liquid etc., simplified flow pattern, reduced operating and maintenance costs, and better process control because fully automatic operation means constantly controlled washing results.

The advantage of the superior washing efficiency achieved by the Larox PF automatic Pressure Filter have been demonstrated in several process steps in the sugar industry giving increased recovery of sugar and other valuable materials.

Further details:

Larox Oy.,
P.O. Box 29,
SF-53101 Lappeenranta 10,
Finland.

Alkaline extraction – the Ponant process

A new leaflet from F. Moret, of 02100 Saint-Quentin, France, reviews the Ponant process for beet juice extraction, patented by the UCB group. It involves the fixing of calcium on the beet tissue in the form of bridges between carboxylic groups in the galacturonic chains forming the pectic substance of the cell walls. This provides a rigid structure and, since the stable links are not broken in alkaline conditions, allows extractions at pH 8.4 (water) to 10.5 (raw juice). The pulp obtained can be pressed to a high dry matter content (40%) with less energy consumed and the diffusion is characterized by lack of corrosion and better bacteriological state. Juice quality is improved and it contains less dissolved pectin; this remains in the pulp, increasing its value.

We supply complete equipment for the international sugar industry:

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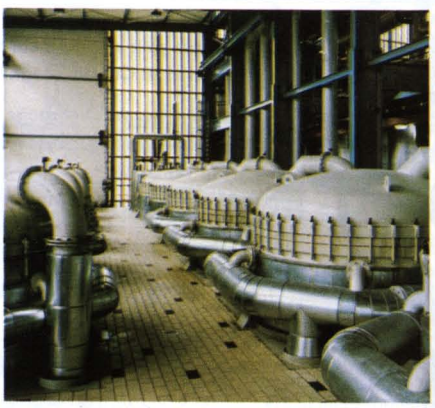
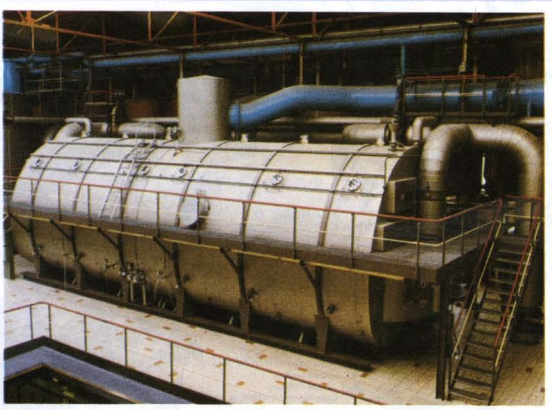


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Facts and figures

Drought in Guyana[1]

It is feared that drought in Guyana will affect not only the current spring crop but also the 1988 autumn crop and also next year's spring crop. The Guyana Sugar Corporation has examined the effects of the drought not only on cane growth but also on systems, infrastructure and equipment. Transportation of cane from the fields to the factories has been badly affected by the reduced water levels in the canals along which punts loaded with cane are usually hauled. It was decided in May to apply supplementary fertilizer to boost cane growth and juice quality for the autumn crop. Various other measures were also decided upon to maximize the benefits from expected rains and so avoid any serious shortfalls in the next two crops.

Cuban sugar factories for Vietnam[2]

Under a cooperation agreement signed in Havana in 1987, Cuba is building a number of sugar factories in Vietnam. Three 500 t.c.d. plants will be built by 1990 and two more later. In addition, a 1500 t.c.d. factory is to be reconstructed and expanded by 1990 and two more are scheduled for 1991/95. Cuba is also to build a molasses terminal in Vietnam.

Mexico sugar exports, 1987[3]

	1987	1986
	tonnes, raw value	
Bulgaria	0	24,256
Ecuador	12,928	0
EEC	123	12,000
Finland	12,312	0
Morocco	68,330	53,000
Trinidad	5,207	0
Tunisia	0	11,400
USA	212,104	118,500
USSR	185,905	0
Venezuela	21,546	0
Total	518,455	219,156

Australian bagasse paper pulp project dropped[4]

The proposal announced earlier[5] to build a bagasse paper pulp plant at Innisfail, in North Queensland, has been dropped by Rothwells Ltd. This merchant bank from Western Australia has spent about $Aus 5 million investigating the project but, instead of proceeding, has issued writs against BHP Co. Ltd. and BHP Engineering Pty. Ltd., alleging misrepresentation regarding the economic and technical feasibility of the project and the pulp making process. It had originally been expected that the plant would use bagasse from three sugar factories to produce 50,000 tonnes of pulp a year.

Guyana spring crop below target[6]

Guyana Sugar Corporation closed its first crop for 1988 at 75.600 tonnes, more than 21,000 tonnes below the initial target, but has met its export requirements to the EEC and hopes to fulfil its US quota with the second crop. The spring crop outturn was the lowest in recent years; in 1987 it was 93,815 tonnes and 124,475 tonnes the year before. The 1988 crop was affected by a four-month dry spell and a three-week strike by sugar workers. Industry sources said that the Corporation, which has embarked on a multi-million dollar diversification program, is unlikely to meet its revised target of 216,700 tonnes for all of 1988.

Argentina sugar distribution quotas[7]

At a meeting of the sugar authorities in Argentina with the heads of the country's sugar producing companies and cooperatives, the production quota for 1988 was maintained at 1,050,000 tonnes, of which 930,000 tonnes is for the domestic market and 120,000 tonnes for exports.

Beet rhizomania virus find

In the course of regular inspection carried out by the Plant Health Inspectorate of the UK Ministry of Agriculture, Fisheries and Food and the Plant Health Laboratory, some infection by rhizomania virus was discovered in the wrapped root balls of acers imported from a nursery in Holland. The virus can only be transferred in soil and infection is unlikely to spread from the source. However, immediate action was taken to follow through the movements of plants imported in the consignment. The Dutch authorities have been informed and have begun their own inquiries, and measures are to be discussed to prevent any recurrence of the incident. British Sugar plc were also informed.

Chinese sweetener supplies[8]

Faced with soaring domestic demand, the Chinese government is looking into the possibility of using corn syrup as a major sweetener, according to the general manager of the China Grain and Oil Import Co. Corn syrup may be China's major sweetener within 5 - 10 years, he said, adding that the country has enough grain to absorb some of the demand. Cuban shipments will amount to 700,000 - 800,000 tonnes, 10 - 15% of which will be in fact from a third country which Cuba will substitute to meet its own commitments to China. Imports from Thailand will rise while purchases from Australia will be similar to last year. China has extended the sugar beet area by 34.7% from 473,000 to 637,000 hectares and the sugar cane area by 7% from 819,000 to 876,000 ha. Based on average sugar yields over the past 5 years this expansion should mean an additional production of some 800,000 tonnes, raw value. However, China will remain a net importer because production will not be sufficient to cover the steadily rising domestic demand.

Hawaii sugar production, 1987[9]

Last year was not a good one for Hawaii's sugar industry. Production fell by 6%, production costs rose by 7% and total revenues were $22 million lower. Five of the 13 plantations lost money and a sixth just broke even. Sugar production in 1988 is forecast at 1,018,500 short tons, however, against 979,209 tons in 1987, and a new sugar yield per acre record of 12.6 tons is suggested which should reduce production costs per ton substantially.

Cuba-Uganda barter agreement[10]

Under an agreement signed recently, Cuba will supply Uganda with sugar and other products in 1988 in exchange for coffee, beans and timber. Cuban sugar exports to Uganda rose from 5416 tonnes in 1986 to 23,628 tonnes last year.

French sugar factory closures[11]

Beghin-Say S.A. has closed its 6500 tonnes/day beet sugar factory at Corbehem. It was the second smallest sugar factory in the group. The Vermandoise Industries group is also planning to close its smallest factory, the 4000 tonnes/day plant at Dompierre-Becqincourt. At the end of 1987 the Montcornet sugar factory of the Sucreries du Nord-Est group was also closed.

Mexico sugar export plans, 1988[12]

Mexico plans to export 700,000 tonnes of sugar, 300,000 tonnes of molasses and 40 million litres of alcohol to international markets in 1988, according to the President of the National Canegrowers Association. Of the sugar, 300,000 tonnes will be exported to China; this is the first time Mexico has exported sugar to that destination. As a consequence during the past six years, sugar production in 1987/88, at 3.5 million tonnes, tel quel, was 160,000 tonnes below that planned and 250,000 tonnes below the 1986/87 outturn.

Soviet hopes for more domestic sugar[13]

Soviet officials are counting on even bigger yields of sugar beet this year than last to cure the country's sugar shortage, but some Western analysts wonder whether it can be done. The shortage could be overcome if 27.1 tonnes of sugar beet were produced per hectare this year, 2.1 tonnes more than the average of the past two years. However, the 1987 harvest was the best crop since 1978 and analysts would be surprised if it were followed by an even better one. Further, construction work on 15 sugar factories under renovation in the Russian Federation is behind schedule and they may not be ready for the new campaign start in September.

Réunion sugar production, 1987[14]

The 1987 season in Réunion, which ended on December 14, produced 225,876 tonnes of sugar, raw value, about 10% less than the 241,000 tonnes produced in the previous season. It was made from a crop of 2,203,036 tonnes of cane, 4.2% higher than in 1986. The sugar content was lower in 1987, at 13.20% against 13.93%.

1 F. O. Licht, *Int. Sugar Rpt.*, 1988, **120**, 317.
2 *Cuba Economic News*, 1987, **23**, (156), 5 - 6.
3 *I.S.O. Stat. Bull.*, 1988, **47**, (6), 27.
4 *Australian Canegrower*, 1988, **10**, (6), 17.
5 *I.S.J.*, 1988, **90**, 75.
6 *Public Ledger*, June 17, 1988.
7 *GEPLACEA Bull.*, 1988, **5**, (7), Sugar Inf.-1.
8 F. O. Licht, *Int. Sugar Rpt.*, 1988, **120**, 359 - 360.
9 *Sugar y Azúcar*, 1988, **83**, (7), 6.
10 F. O. Licht, *Int. Sugar Rpt.*, 1988, **120**, 377 - 378.
11 *Zuckerind*, 1988, **113**, 631.
12 *GEPLACEA Bull.*, 1988, **5**, (7), Sugar Inf.-3.
13 *Public Ledger*, July 30, 1988.
14 *Zuckerind*, 1988, **113**, 631.

Compartiendo conocimientos

La Sociedad de los Seminarios Inter-Americanos de la Caña de Azúcar

La caña de azúcar es una fuente vital de alimento y energía que influye notablemente en la economía de muchos pueblos. Para aprovechar al máximo su potencial, es importante compartir conocimientos, diseminando libremente todo lo relacionado con su tecnología, en un ambiente totalmente cientiífico y no-comercial.

Ésto es la filosofía de la Sociedad de los Seminarios Inter-Americanos de la Caña de Azúcar, una Sociedad no-lucrativa que organiza los seminarios anuales y otros eventos similares en el Hemisferio Occidental, donde se presentan y discuten libremente, los adelantos y experiencias de la industria de la caña de azúcar y sus subproductos.

Los seminarios tienen lugar anualmente en el Centro de Convenciones James L. Knight, con presentaciones de trabajos, paneles de discusión y entrega de premios, todo con interpretación simultánea. Las memorias del evento se publican en inglés y español; una valiosa fuente bibliográfica de ciencia y tenología de la caña de azúcar.

La ciudad de Miami ofrece excelentes facilidades para la comodidad de los participantes a éstos y otros eventos organizados por la Sociedad. Además, se está a corta distancia del área cañera de Florida y de instituciones de investigación. Las giras de campo a estas instituciones resultan experiencias provechosas y han proveido la oportunidad de reunirse con los patólogfos, entomólogos y geneticistas de la Estación de Hibridación del USDA en Canal Point; observar el trabajo que realizan los especialistas en suelo y economistas de la Estación EREC de la Universidad de Florida en Belle Glade; conocer sobre el manejo de recursos naturales en la central de computadores y estaciones de bombeo del Distrito de Riego y experimentos sobre energía alternativo de biomasa en Ona, etc.

Entre los tópicos discutidos en pasados seminarios se encuentran las enfermidades de la caña, plagas de insectos y roedores, variedades y fitomejoramiento, fertilidad y manejo de suelos, control de malezas y maduradores, riego y drenaje, energía y subproductos de la caña; usos de azúcar, energía y subproductos.

El Seminario Inter-Americano de la Caña de Azúcar de 1988, que tendrá lugar durante 21 - 23 de septiembre, comprendrerá tres temas de actualidad y de mucha importancia para la industria azucarera: Computadoras, Automatización y Gerencia. Estas tres especialidades han sufrido rápidos y drásticos cambios en los últimos tiempos, despertando gran interés entre los elementos azucareros. En este Seminario los participantes tendrán la oportunidad de obtener mayor o mas actualizada información sobre técnicas operacionales de manejo para la producción de caña de azúcar y/o su procesamiento; gerencia, coordinación y organización de las operaciones de campo y fábrica, equipo y personal; automatización de sistemas, cómputo y control de las operaciones de campo, fábrica y oficina mediante computadoras; además, programas de computadoras para el manejo de datos, análisis estadístico, control de calidad y otras de las muchas aplicaciones que pueden tener las computadoras en la industria.

Este año durante el día normalmente dedicamos a la gira de campo, se hará una demostración de programas de computadora. Especialistas de la Universidad de Florida harán presentaciones sobre el uso de la computadoras en las operaciones de campo, gerencia financiera y otros aspectos de la producción cañera. Habrá una sesión plenaria para explicar, con la ayuda de un proyector gigante, la operación paso por paso de varios programas de computadora, mientras que los participantes formarán pequeños grupos para recorrer las distintas estaciones de computadora instaladas en el salón, obteniendo así una demostración mas objetiva y mayor información sobre la variedad de programas disponibles, aparte de poder intercambiar impresiones con los especialistas. El Presidente de la Sociedad, Sr. Diego R. Suárez, y el Presidente del Comité Técnico Organizador, Dr. Alfonso L. Fors, desean hacer de este Seminario de 1988 un evento extraordinario.

Los patrocinadores y co-patrocinadores

Los patrocinadores de los Seminarios están la Ciudad de Miami y Inter-American Transport Equipment Company; los co-patrocinadores incluyen universidades importantes, estaciones de investigación del Departamento de Agricultura de los EE.UU., *Diario Las Américasπ* y la Organización de Estados Americanos.

Miami es un cruce entre las Américas y una portal al resto del mundo. Como puerto internacional para hombres y productos, su accesibilidad, localización central, clima subtropical y excelentes hoteles y facilidades para comer, de entretenimiento y para asembleas cree un ambiento excepcionalmente agradable para los científicos y técnicos que asisten en los Seminarios. Además, Miami es en la proximidad de una de las más fertiles áreas cañeras y uno de los más significantes industrias azucareras del Hemisferio Occidental, donde la importancia de la más reciente tecnología es bién reconocida. Patrocinio por la Ciudad de Miami demuestra su reconocimiento de la importancia de la industria azucarera al bienestar del estado de la Florida y aún a la ciudad.

Inter-American Transport Equipment Company es bien conocido como fuente de un rango de equipo agrícola, de herramientas para cultivo del suelo a cosechadores de caña de tallo entero, marca Thomson, y de caña en trozos, marca Claas, éstos construidos en Alemania para la compañía. Diseño, desarrollo y asemblea de todo es hecho a Miami, así como la mayoria de la fabricación. Aún las llantas están hecho especialmente para cumplir con normas especificados para equipo Vanguard,

que toma su nombre de un pueblo cubano donde Sr. Diego R. Suárez, Presidente de la compañía, comenzó el diseño y fabricación de remolques para caña a principios de la decada de los 1950s.

El Centro Everglades de Educación e Investigación (CEEI), de Belle Glade, en Florida es co-patrocinador de los Seminarios y es uno de los muchos Centros operados por el Instituto de Alimentos y Ciencias Agrícolas (IACA), de la Universidad de Florida. CEEI es especial porque es el único centro académico de investigación agrícola ubicado en suelos orgánicos subtropicales en los Estados Unidos. El área de cultivo alrededor del extremo sur del Lago Okeechobee produjo mas de $1500 millones en las ventas de productos agrícolas de los cuales alrededor de $700 millones están relacionados con la industria del azúcar de 1987-88. El CEEI tiene programas de extensión y de investigación activa que mejorarán las prácticas de la producción de caña de azúcar y conservarán y protegerán los recursos del suelo y del agua en la zona sur de Florida. Específicamente, el Centro está: participando en un programa de hibridación en Canal Point, en Florida; desarrollando las mejores prácticas de manejo; estudiando la dinámica de la población de gusanos blancos; y, iniciando un trabajo acerca de la enfermedad del corazón negro de la caña de azúcar.

La Universidad de West Indies sirve principalmente a las Islas de habla inglesa del Caribe. En este grupo están incluídos los siguientes países donde se cultiva la caña de azúcar: Guyana, Belize, Barbados, St. Kittis/Nevis y Trinidad and Tobago. El azúcar ha sido por muchos años el sostén principal de las economías de estas islas especialmente de los territorios no productores de petróleo como Belize, Barbados y Guyana. La investigación y el desarrollo de la tecnología del azúcar fue formalmente desarrollada en el Imperial College of Tropical Agriculture en St. Augustine. Se ha realizado mucha investigación básica en esta institución. La Universidad de West Indies como institución sucesora con sus Facultades de Agricultura e Ingeniería ha continuado con esta tradición de investigación y enseñanza en las áreas de la caña de azúcar y sus productos secundarios. Se ofrece un curso final optativo de un año en tecnología del
azúcar en el B.Sc. (Eng) en el programa de Ingeniería Química. Continuamente se dan cursos de educación en áreas tales como mantenimiento de la fábrica azucarera y operaciones de cocción. La investigación se ha centrado principalmente en los siguientes puntos básicos: desarrollo de nuevas técnicas de procesamiento, análisis de problemas en procesamiento, conservación de energía, control de la contaminación/utilización de los desperdicios, técnicas analíticas; aplicaciones a la computación, y producción de etanol. El papel de la Universidad como co-patrocinador de los Seminarios Inter-Americanos de la Caña de Azúcar se permite compartir su conocimiento y formar algunas ideas acerca de la producción de la caña de azúcar y de la investigación del procesamiento especialmente en la Cuenca del Caribe.

El valor anual de la cosecha de la caña de azúcar de Louisiana es aproximadamente de $275 millones. La cercana proximidad entre los productores y los procesadores y el uso extenso de equipo especializado, fabricado localmente, crea un impacto económico bastante grande sobre las comunidades donde tienen lugar estas operaciones. Por consiguiente, la industria de la caña de azúcar de Louisiana contribuye en forma significativa a la economía del Estado. La historia de la industria del azúcar de Louisiana se ha caracterizado por su consolidación, expansión y avance tecnológico. Un siglo atrás habían 1200 fábricas de azúcar crudo en el Estado. El número ha disminuído continuamente, mientras que las fábricas centralizadas se han expandido para procesar la caña de las haciendas vecinas. El Estado tiene ahora 21 fábricas de azúcar crudo, con una capacidad de procesamiento promedio de más de 5000 toneladas de caña por día. Aunque el número de productores ha disminuído a algo de 800, la superficie usada para el cultivo de caña de azúcar ha permanecido estable. Al igual que con las otras industrias agrícolas se espera que esta tendencia continúe. Los más eficientes competirán, mientras que a los relativamente ineficientes les será muy difícil sobrevivir. A medida que los miembros de la industria de la caña de azúcar de Louisiana se esfuerzan para aumentar su eficiencia, ellos miran hacia el Centro Agrícola de la Universidad Estadual de Louisiana en busca de nueva tecnología y conocimientos. El generar conocimiento y tecnología relevantes es el proceso último que comienza dando prioridad al problema del área y culmina con el pensamiento creativo de los investigadores científicos. El pensamiento creativo y la concepción de ideas nuevas son estimulados a través de la interacción entre profesionales. De esta manera el Centro Agrícola de la Universidad del Estado de Louisiana está abierto para co-patrocinar seminarios que compartan esta filosofía.

El US Sugarcane Field Laboratory en Houma, Louisiana, conduce investigaciones en el campo de realce del germaplasma y mejoramiento de prácticas en la producción de caña de azúcar cultivada en condiciones subtropicales. A causa de la naturaleza aplicada de las investigaciones el laboratorio se esfuerza en transferir rápidamente la tecnología para su uso por productores y procesadores de caña de azúcar en los EE.UU. de A., especialmente aquellos en la zona del delta meridional del río Mississippi. También, los científicos del laboratorio se ocupan activamente con el intercambio de resultados de la investigación con otros científicos quienes trabajan con caña de azúcar en todas partes del mundo. Los Seminarios Inter-Americanos de la Caña de Azúcar han llegado a ser un excelente vehículo para la difusión como para el intercambio de información. Los temas para cada Seminario son oportunos, y las presentaciones se han organizado para permitir un examen

comprensivo de las materias elegidas. El Laboratorio, como co-patrocinador, espera respaldar los Seminarios en el futuro.

Otros co-patrocinadores de los Seminarios incluyen el Colegio de Ingeniería y Ciencias Aplicadas de la Florida International University; el Departamento de Agricultura de la Nicholls State University en la Louisiana; el Colegio de Agricultura de la University of Georgia; el recinto de Mayagüez de la Universidad de Puerto Rico; la estación en Weslaco, Texas, del Agricultural Research Service del US Department of Agriculture; *Diario Las Américas* y la Organización de Estados Americanos.

Acciones de GEPLACEA en el área de la tecnología azucarera

por Antonio Celso Sturion*

GEPLACEA – Grupo de Países Latinoamericanos y del Caribe Exportadores de Azúcar – es un organismo regional formado por 22 países de América Latina y El Caribe, que fue constituído en Cozumel, México, en noviembre de 1974.

GEPLACEA, además de constituir el Grupo más importante de países productores de azúcar de caña en el mundo, es un órgano de consulta, coordinación e información para los países miembros sobre cuestiones comunes relativas a la producción y comercialización del azúcar, además de contribuir a la creación de mecanismos adecuados para instrumentar fórmulas de cooperación e integración, propiciando el desarrollo armónico de la industria azucarera de los países miembros.

Para su funcionamiento GEPLACEA tiene como órganos permanentes la Asemblea y el Secretariado. La Asemblea, órgano supremo del Grupo, está integrada por representantes de todos los países miembros y se reúne una vez al año. El Secretariado, organo ejecutivo del Grupo que funciona en forma permanente, con sede en la Ciudad de México, está constituído por el Secretario Ejecutivo, el Secretario Ejecutivo Adjunto, el Secretario Asistente en Mercado, el Secretario Asistente en Tecnología y el personal técnico y administrativo.

Entre los objetivos y funciones de GEPLACEA, están los relacionados con los aspectos tecnológicos de la agroindustria de la caña de azúcar, o sean:

– Intercambio de conocimientos científicos y tecnológicos en materia de campo, fábrica y utilización de los subproductos de la caña de azúcar.

– Análisis de las posibilidades de complementación industrial en todas las ramas de la actividad de la industria azucarera.

GEPLACEA actúa a través de una serie de programas destinados a cumplir con los objetivos del Grupo, y los relativos a la tecnología son los siguientes:

– Agricultura Cañera,
– Eficiencia Industrial,
– Derivados y Subproductos, y
– Cooperación Energética.

El Programa de Agricultura Cañera tiene por objetivo general la búsqueda de aumento de productividad de los campos cañeros de los países miembros del Grupo, procurando hacer más eficiente las tareas ligadas a la agricultura de la caña de azúcar.

En este Programa se pretende poner un énfasis especial en aquellos aspectos susceptibles de coordinar áreas de común preocupación en nuestros países y abordar, principalmente mediante la cooperación técnica horizontal, la solución de problemas específicos que se requieren en áreas o países determinados.

Para logro de estos objetivos generales, actualmente se están desarrollando las siguientes acciones:

– Intercambio de variedades comerciales e integrales;

– Conformación de un Banco Regional de Cuarantena y de dos Bancos Regionales de Variedades comerciales;

– Asesoramiento directo a los países miembros en los aspectos relacionados a la agricultura cañera.

Además de estas acciones, GEPLACEA coopera para el financiamiento de la participación de técnicos

* Secretario Asistente en Tecnología de GEPLACEA

cañeros de países miembros, en eventos internacionales y regionales, así como también en las realización de diferentes actividades de difusión y transferencia de tecnología, tales como la edición de publicaciones, elaboración de videos y realización de conferencias, seminarios y talleres sobre la agricultura cañera.

En el Programa de Eficiencia Industrial, se desarrolló, con la cooperación del Programa de las Naciones Unidas para el Desarrollo (PNUD) y la Organización de la Naciones Unidas para el Desarrollo Industrial (ONUDI), el Proyecto Regional de Mantenimiento y Reparación de la Industria Azucarera de América Latina y el Caribe.

Este Proyecto tuvo como propósito la disminución de los costos, mediante la aplicación de técnicas modernas en las reparaciones y el mantenimiento preventivo, imprimiendo en estas actividades una mayor eficiencia. En este campo se llevaron a cabo cursos de entrenamiento, seminarios, demostraciones prácticas y asistencia técnica directa, además de la edición de 10 publicaciones específicas sobre el tema.

Así mismo, bajo el marco del Programa de Eficiencia Industrial, se trabaja en la unificación de los métodos de análisis utilizados en la agroindustria de la caña de azúcar en la región. Por lo anterior, se publicaron: El Manual Unificado de Técnicas Analíticas de Azúcar y Mieles para América Latina y el Caribe (en español); El Manual para Analistas de Laboratorio Azucarero – Químico de Banco (en español) y el Manual de Análisis Químico del Etanol (en español e inglés).

En el marco del Programa de Derivados y Subproductos se está desarrollando, con apoyo financiero del PNUD, el Proyecto de Diversificación de la Agroindustria Azucarera de América Latina y el Caribe, el cual tiene como principal objetivo, propiciar el desarrollo de la agroindustria azucarera y está orientado hacia un concepto de integración industrial azúcar-derivados. Más que ser una respuesta a la crisis de la agroindustria cañera, se concibe como una iniciativa viable para el desarrollo integral del sector azucarero regional en el marco de la reconversión industrial.

El Proyecto pretende crear una infraestructura para la promoción de métodos y sistemas de cooperación técnica e intercambio de conocimientos científicos y tecnológicos sobre la diversificación, a través de difusión de resultados de experiencias de los países miembros. En este contexto se da prioridad a la realización de estudios de proyectos de diversificación y a la asistencia técnica directa para su implementación a los países miembros.

Los resultados del Proyecto deberán reflejarse en los siguientes aspectos:

– Una reducción de la vulnerabilidad de la agroindustria azucarera a la situación del mercado internacional;

– Mayor eficiencia económica en términos de beneficio-costo;

– Mayor eficiencia energética y tecnológica;

– Ampliación de la cooperación técnica y transferencia tecnológica entre los países miembros;

– Ampliación de perspectivas para la creación de un mercado intra-regional de derivados;

– Sustitución de importaciones y creación de excedentes exportables, con lo que se generaría una fuente adicional de divisas, etc.

Además de la realización de seminarios, conferencias y asistencia técnica directa a los países miembros, se editaron 11 publicaciones específicas sobre diferentes aspectos de la diversificación de la agroindustria azucarera.

También, bajo el Programa de dicho Proyecto, se tienen planeadas a corto plazo las siguientes actividades:

– La creación de un sistema de información e intercambio de experiencias;

– La realización de un Directorio Internacional de Fabricantes, Usuarios y Distribuidores de Derivados y principales productos competitivos o similares;

– La elaboración final y publicación de los Perfiles Económicos y Azucareros de los Países miembros; y

– La realización de diferentes eventos sobre biotecnología, contaminación ambiental y diversificación, así como las memorias correspondientes.

El Programa de Cooperación Energética, también enmarcado dentro de las actividades de la Secretaría Asistente en Tecnología, está destinado a realizar investigaciones aplicadas al conocimiento y desarrollo integral del potencial energético de la caña de azúcar y su divulgación entre los países miembros del Grupo.

La producción de alcohol carburante y para otros usos, está contemplada dentro del Programa de Cooperación Energética. Con la colaboración de otros organismos regionales, se atiende el desarrollo y aplicación de técnicas eficientes en la fermentación, destilación y producción de alcohol para usos diversos, y el análisis de las condiciones existentes en los países miembros que pretenden emular los casos de Argentina, Brasil y El Salvador, en el uso del alcohol como carburante.

La racionalización energética de ingenios azucareros, también bajo el marco del Programa de Cooperación Energética y con la colaboración de otros organismos regionales, se ocupa del uso y generación de energía en la agroindustria azucarera, mediante la utilización eficiente del bagazo como combustible, lo cual permite la generación de electricidad excedente para su utilización en la red eléctrica nacional o en otras empresas industriales, así como un posible ahorro de bagazo para su empleo en la industria de derivados (tableros, furfural, pulpa y papel, etc.).

Por lo expuesto anteriormente, se oberva que, aún cuando la actuación de GEPLACEA en los temas relativos al mercado internacional del azúcar continué siendo uno de los principales objetivos del Grupo, en la actualidad el mismo busca orientar las acciones de manera que los temas relacionados con la tecnología para la agroindustria de la caña de azúcar, tengan un papel de relieve dentro de los objetivos de GEPLACEA y de sus acciones junto a los países miembros.

Cambios en el arreglo de compras de azúcar por los E.E.U.U.

por Rodney Goodwin

No hay duda que, si se formaran el intento de hacerlo, los E.E.U.U. de A. podrían sin dificultad ser autosuficientes en edulcorantes. Por cierto, el modelo que se ha establecido en los últimos años ha conducido a aprensiones de que al final de la década actual esta posibilidad puede ser un hecho y las importaciones de azúcar extranjero pueden hacerse una cosa del pasado. Afortunadamente para los suministradores de ultramar, todas las indicaciones parecen mostrar que el año próximo habrá un aumento en las importaciones necesarias; no obstante, los suministradores pueden con justicia sentirse ofendidos por el tratamiento al que han sido sujetos en los últimos años y especialmente desde el comienzo de la década de los 1980s.

Durante muchos años, los suministros de azúcar a los E.E.U.U. de A. fueron controlados cuidadosamente por la operación de un sistema de cuotas que aplicaban a productores ambos domésticos y extranjeros. Para la mayoría de éstos últimos, el mercado de los E.E.U.U. de A. llegó a ser un mercado mayor sólo desde 1960. Antes de esta fecha, las Filipinas recibían una cuota regular fija de 980,000 toneladas cortas, en términos de valor crudo, mientras que todas las otras necesidades de importación se dividían entre Cuba por una parte y todos los otros suministradores extranjeros por otra parte, con las entregas de Cuba comprendiendo más del 90 por ciento del total. El tonelaje real suministrado cada año varió de acuerdo con la cantidad de necesidades domésticas mientras que el reparto de déficites de cuotas condujo a cambios de derechos. Aunque la posición dominante de Cuba como suminstrador disminuyó en verdad durante la década de los 1950s, siendo reducida de 98.64 por ciento de todo el azúcar importado de países extranjeros fuera de las Filipinas a 96.0 por ciento en 1953 y otra vez a 93.75 por ciento en 1957, este país era sin embargo el mayor suministrador al comienzo de 1959 cuando las fuerzas revolucionarias de Fidel Castro tomaron poder en la isla.

No pasó mucho tiempo antes que emergieran diferencias mayores entre los gobiernos de Cuba y de los Estados Unidos. El programa cubano de reforma agraria, que incluyó algunas nacionalizaciones de propiedades estadounidenses, causó inquietud considerable en los E.E.U.U. de A. y cuando, después de éstas, al comienzo de 1960, ocurrió una serie de ventas a miembros del bloque socialista, importaciones adicionales de azúcar cubano a los E.E.U.U. de A. fueron prohibidas. En verdad, aunque esto ocurrió en julio de 1960 y la cuota cubana para ese año fue más de 3.1 millones de toneladas, sólo unas 700,000 toneladas fueron excluísas porque la acción se había esperado por todas partes. Sin embargo, desde aquella fecha no se ha permitido más la entrada de azúcar cubana en los E.E.U.U. de A.

Necesidad para repuestos de azúcar cubano

La eliminación de este mayor suministrador tuvo como resultado que los E.E.U.U. de A. tuvieron que buscar repuestos. Las Filipinas ya eran una fuente importante y podían aumentar sus entregas, pero ningún otro país tenía una cuota tan grande como 100,000 toneladas. Algunos estaban listos a desviar suministros de otras destinaciones al mercado más remunerador en los E.E.U.U. de A. mientras que otros aumentaron su producción. Algunos productores que no figuraban como suministradores a los E.E.U.U. de A. comenzaron también a hacer entregas regulares.

La posición dominante de Cuba como suministrador extranjero al mercado estadounidense antes de la prohibición de su azúcar puede notarse en las cuotas finales de entrega a los E.E.U.U. de A. en 1959, el año anterior al que la prohibición entrara a operar, y son las siguientes (Tabla I):

Por 1963 el número de suministradores con entregas de más de 100,000 toneladas había aumentado a diez con una lista de orígenes mucho más comprensiva que previamente. También, presión considerable se desarrolló de productores en los E.E.U.U. de A. para obtener permiso para aumentar la cantidad que podían suministrar al mercado doméstico, y en 1964 ocurrió la primera reducción premeditada en los derechos de suministro de paises del ultramar para que productores domésticos de azúcar de caña y de remolacha pudieran disfrutar de una repartición más grande.

Tabla I

	Toneladas cortas de azúcar, valor crudo
De remolacha doméstica	2,267,665
De caña continental	697,783
Hawai	977,970
Puerto Rico	969,875
Islas Vírgenes	12,405
Filipinas	980,000
Cuba	3,215,457
Países - derechos completos de aduana*	278,845
	9,400,000
*De los cuales	
Perú	95,527
República Dominicana	81,457
México	64,809
Nicaragua	14,027
Haiti	7,014
Otros paises	16,011
	278,845

Esto fue probablemente un reconocimiento realístico del hecho que la mayoría de los productores domésticos podían aumentar su producción para reemplezar suministros cubanos igualmente que los productores extranjeros, aunque durante los años subsecuentes la importancia de Puerto Rico como productor de azúcar declinó rápidamente.

Los suministradores extranjeros no expresaron reclamaciones en esta época y, a pesar del aumento en los suministros de orígenes domésticos, necesidades de azúcar extranjero aún crecían. En los primeros cinco años después de la prohibición de importaciones de azúcar cubano, el promedio de entregas netas de paises extranjeros fue de más de 4.1

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millones de toneladas cortas, una cifra que fue sobrepasada ligeramente en los años 1971 a 1975. Ya se podía pronosticar que el período de aumento regular estaba terminando. En el período posterior de cinco años hubo importaciones promedias de 4.7 millones de toneladas pero en los cinco años hasta 1985 declinaron a menos de 2.9 millones de toneladas.

Frecuentamente, las razones de cambios no están bien definidas y hubo algunos factores que condujeron a la caída de importaciones de azúcar. Si tenemos que indicar con toda precisión una sola causa fundamental, fue probablemente la bonanza de precios que ocurrió en 1974 y 1975 que estimulaba la producción del jarabe con alto contenido de fructosa (HFS) de maíz como fuente. La tecnología habia estado disponible desde algún tiempo; la llegada de azúcar costoso se presentó con un mercado. Siguieron inversiones sustanciales en nuevas facilidades y el uso de HFS se extendió rápidamente entre los fabricantes de bebidas no-alcohólicas. Cuando Coca-Cola anunció que permitia su uso, el mercado se estableció; actualmente hay pocas bebidas de aguas minerales en los E.E.U.U. de A. – fuera del sector dietético – que no se endulzan con HFS.

Vencimiento del Sugar Act

Después de cuarenta años el Sugar Act, regulando el flujo de entregas en el mercado de los E.E.U.U. de A., se ha permitido expirar a fines de 1974. Esto terminó el sistema de cuotas y los E.E.U.U. de A. se hizo una destinación de mercado libre. Productores domésticos – y hasta cierto punto unos de los más pequeños productores – recibían protección fiscal pero inicialmente ésta no se requiería mucho porque se pagaban altos niveles de precios. Sin embargo, cuando estos estaban cayendo, los productores domésticos se quejaron de presiones financieras. Esta situación condujo a una concesión de dobles beneficios para ellos; los derechos de aduana aumentaron y se inauguró un programa de préstamos. Este se propuso para proveer asistencia transitoria sin carga; en el evento, permite que los productores puedan perder su azúcar y el gobierno de los E.E.U.U. de A. adquiere la responsibilidad de su disposición.

Una segunda – pero menos dramática – bonanza de precios ocurrió en 1980 y 1981. En esta época se promulgaba nueva legislación agricola que incluyó medidas para ayudar a productores domésticos de azúcar. No es posible decir de qué modo el juicio de los legisladores fue influenciado por los altos precios pagados por el azúcar, pero un precio de apoyo por préstamos se estableció el que comenzó a 17.00 centavos por libra en octubre de 1982 y creció a 18.00 centavos por libra en los tres años posteriores.

Esto socavó finalmente la posición de los suministradores extranjeros por apuntalamiento de productores domésticos no solamente de azúcar de caña y de remolacha sino también de HFS. Además, los altos precios de apoyo para edulcorantes calóricos animaba el uso, donde fuera apropriado, de edulcorantes no-calóricos.

Cuotas para importación se reintrodujeron en 1982 después de un intervalo de siete años. Se han establecido sobre una base de entregas del pasado pero desafortunadamente estaban a niveles mucho más bajos que ellos antes de la interrupción.

Sin limitaciones oficiales a la producción de edulcorantes domésticos pareció que, cuando las cuotas de importación cayeron año a año, las proyecciones de que las importaciones no se necesitarían a fines de la década pudieron no estar lejos de la verdad. Este año, el total de las cuotas iniciales fue solamente 758,000 toneladas, después de un poco más de un millón de toneladas en 1987. En el evento, esta cantidad ha resultado demasiado pequeña para satisfacer las necesidades de los E.E.U.U. de A. este año y acaba de anunciarse un aumento de unas 300,000 toneladas, que lleva el total de cuotas para este año a 1,056,675 toneladas cortas. Aún así, el tamaño de la caída del mercado para azúcar extranjero en los E.E.U.U. de A. ha sido considerable. Esto se ilustra claramente con una comparación entre importaciones reales a los E.E.U.U. de A. de algunos de los mayores orígenes en 1974 – el último año del sistema antiguo de cuotas – y en 1982, cuando fueron reintroducidos. La caída posterior en el mercado se indica por las cuotas para el año actual (Tabla II).

Tabla II

Importaciones por los E.E.U.U. de A. Cuotas

	1974	*1982*	*1988*
	Toneladas cortas, valor crudo		
Argentina	109,742	171,027	43,175
Australia	241,702	168,627	83,335
Brasil	783,491	273,277	145,590
Antillas y Guyana (a)	283,332	92,680	47,505
Colombia	104,828	35,542	24,100
República Dominicana	822,498	362,587	176,710
México	538,113	153	8,000
Perú	488,134	76,223	41,165
Filipinas	1,472,556	203,365	158,640
Tailandia	226,219	322,224	14,055
Zimbabwe	0	102,152	12,0050
Otros países	916,530	829,625	302,350
	5,787,145	2,637,482	1,056,675

(a) Ahora se alocan cuotas para países individuales pero una cifra compuesta es indicada para fines de comparación

En realidad, a pesar de algunas pronósticos pesimistas, parece que habrá una necesitad más grande para azúcar extranjero en los E.E.U.U. de A. en el año próximo. Esto resulta de varias causas. A pesar de un área más grande para este campaña, se espera una caída sustancial en la cosecha de azúcar de remolacha. La remolacha en la región del Valle del Red River ha sufrido severamente la sequía, mientras que se informa de la incidencia de la enfermedad de amarillo viral en muchas partes de California. Como resultado de ésto, algunas autoridades sugieren que la producción de azúcar de remolacha siguiente puede ser tanto como 600,000 toneladas menos que las 3.95 millones de toneladas cortas producidas en 1987/88. Naturalmente, ésto ha sido una de las razones principales para el aumento

reciente de la cuota para este año. Entretanto, el crecimiento rápido en el sector de HFS parece está terminando. Su mercado natural en el sector de bebidas no-alcohólicas se está casi saturándose, mientras que se opera casi a la capacidad de las instalaciones actuales. Por ésto, es improbable que absorberá mucho más del mercado existente para edulcorantes calóricos, a no ser que su producción en una forma cristalina y con un precio atractivo se transforme en una proposición práctica. Todos estos factores deben ser considerados tomando en cuenta una demanda creciente de educorantes calóricos.

Perspectivas para demanda aumentada de azúcar extranjero

El aumento en la cuota para este año se reflejará en las estadísticas para 1989; sin embargo, algún aumento adicional puede esperarse y una cuota de importaciones para el año próximo cerca de 1.2/1.3 millones de toneladas cortas parece realista. Por lo tanto, en la ausencia de acción específica por parte de las autoridades estadounidenses para cambiar los arreglos existentes, podemos presumir que la necesidad para importaciones continuará reflejando necesidades residuales después que se han tenido en cuenta los suministros domésticos. El contratiempo actualmente indicado para el sector de la remolacha no se puede esperar que se repita y por cierto los precios atractivos hechos posibles por los arreglos fiscales en los E.E.U.U. de A. parecen señalar una extensión adicional del área. Por otra parte, claramente, podemos esperar que el nivel global de consumo de edulcorantes calóricos continuará creceiendo también, lo que absorberá algo de la producción adicional doméstica que se espera.

Con tantas incognitas, es difícil proyectar hacia el futuro más allá del año próximo, pero, si los arreglos actuales continúan sin cambio, esperanzas de un mercado continuo para azúcar de mucho más de un millón de toneladas no parecen ser justificadas.

La política proteccionista que se ha adoptado ahora en el sector de azúcar de los E.E.U.U. de A. es contraria a los deseos de la Administración del país, que prefiere que el precio de apoyo se reduzca. Esto haría que la producción de azúcar y HFS sean menos atractivas. Sin embargo, mientras que había apoyo para esta opinión en algunas secciones, las casas del Congreso hasta ahora han desechado cualquiera proposicion que pueda conducir a un aumento del elemento extranjero en el consumo doméstico. Es probablemente poco realista esperar un cambio como resultado de las elecciones que ocurrirán más tarde en este año; cualquier cosa que pase a nivel presidencial, el Congreso quedará probablemente en manos Democráticas. Tenemos que contar que éste, más el poder del "lobby" de los productores de maíz, sin contar el "lobby" azucarero, asegurarán que nada se haga que pueda debilitar la atrincherada posición actual de los productores domésticos.

Se tiene que recordar que no existe más un Sugar Act que puede enmendarse sin afectar otras mercancías. Ahora, azúcar es solamente un elemento en una Ley Agrícola amplia de modo que cambios fundamentales en arreglos domésticos no se intentarán sin pensarlo bién. En todo caso, azúcar no es más la importante mercancía de importación que era una década atrás y interés en ella ha diminuído.

Todo esto no ha evitado las sugerencias de varios partidos interesados en que un grupo u otro reciba tratamiento preferencial en el modo en que se alocan las cuotas. Actualmente se consideran proposiciones que darían preferencia a países de bajos ingresos. La historia parece indicar que éstas no tienen una mejor probabilidad que las otras proposiciones que se han considerado en los últimos años.

Otra sugerencia que emerge de vez en cuando puede permitir importación de azúcar crudo por refinadores en los E.E.U.U. de A. en exceso de la cuota y su exportación posterior en forma refinada. No importa la expresión de esta idea, para hacerla una proposición práctica requerirá la provisión de una subvención por la parte de los contribuyentes de los impuestos en los E.E.U.U. de A. Es siempre posible que ésta puede caerle en gracia a la nueva Administración en el año próximo, pero parece demasiado tarde para inscribir alguna acción efectiva en el código de leyes en 1988.

Influencia del GATT

Es posible que acción de este tipo pueda considerarse contraria a las provisiones del GATT y ésto puede hacerla poco atractiva en esta hora cuando el GATT se ocupa con el desmontaje de provisiones fiscales que afectan el comercio de productos agrícolas.

Los E.E.U.U. de A. han sido muy francos en sus llamadas para reducir tarifas en el sector agrícola de todo el mundo y han presentado un programa al GATT para la eliminación de todas las subvenciones agrícolas durante un período de diez años. Otros miembros del GATT han propuesto medidas menos drásticas, pero Australia ha afirmado ya que tomará acción para reducir la protección doméstica para muchas mercancías e industrias. En el sector del azúcar se piensa sustituir el presente embargo sobre importaciones por una estructura de impuestos reduciendos.

En diciembre de este año, miembros del GATT se reunirán en Montreal para el convenio que marcará la etapa media del programa que comenzó en la Uruguay en 1986. Entre sus fines están la liberalización más amplia del comercio agrícola por, entre otras cosas, la reducción de barreras de importación y un mayor control sobre el uso de subvenciones directas e indirectas. Mientras que, al momento, ha habido poco progreso y es todavía difícil ver una base común entre algunos de los más importantes miembros, se han sometido proposiciones de varios países y grupos de países; un cierto momento se ha desarrollado y se espera alcanzar, al menos, un acuerdo de evitar el crecimiento de impedimentos fiscales al

comercio. Desde el punto de vista a largo plazo, las propuestas del GATT pueden conducir eventualmente a una reducción en la política proteccionista de los E.E.U.U. de A. que han hecho tanto daño a los países suministradores.

Resumen

Los E.E.U.U. de A. nunca han vacilado en el uso del comercio del azúcar como un arma política. La eliminación de la cuota cubana es el primer ejemplo de ésto, pero las indústrias azucareras de la República Dominicana, Nicaragua y de Panamá han sido todas penadas en diversas ocasiones. Cuotas han sido conferidas sobre una base preferencial a países vecinos o indigentes. Un resultado directo de la eliminación de la cuota cubana fué una expansión de las importaciones de otros suministradores y un aumento también en su número, con beneficios considerables para ellos como consecuencia de sus nuevos derechos. Sin embargo, ahora, debido a una expansión de la producción de edulcorantes de fuentes domésticas, el mercado para azúcar extranjero ha menguado. Las perspectivas inmediatas son para un probable aumento en las necesidades de importación en 1989 pero una reducción de ahí en adelante. Ha habido una serie de propuestas que el Congreso ha considerado que pueden hacer crecer las cuotas de un grupo u otro o aún aumentar los tonelajes globales que podrían enviarse a los E.E.U.U. de A., pero hasta ahora todas se han malogrado y existe poca razón para creer que propuestas en el futuro tendrán una mejor posibilidad de éxito.

El paso actual del GATT tiene por finalidad la reducción de las medidas de apoyo agrícola. El grado de éxito en la cooperación internacional en asuntos de mercancías en los últimos años no ha sido impresionante y no tenemos que esperar demasiado, pero si con el tiempo acciones se toman de concierto para reducir apoyo fiscal para productores domésticos, es probable que los cultivadores domésticos de las cosechas azucareras de los E.E.U.U. inviertan su política reciente de expansión, dejando oportunidades más grandes para suministradores extranjeros.

Conferencia de tecnólogos azucareros Argentinos

La 5ª reunión de la Sociedad Argentina de Tecnólogos de Caña de Azúcar (SATCA) se celebró a fines de abril en Hotel El Jardín de la ciudad de San Miguel de Tucumán. El Sr. J. M. Hinojo, Presidente de la Sociedad, dió la bienvenida a los delegados y S.E. Gobernador Provincial inauguró oficialmente la conferencia. La ceremonia de apertura continuó con presentaciones sobre el impacto de alcohol como combustible sobre la salud y el medio ambiente, por un representante de la Environmental Protection Agency de los E.E.U.U.; el estado actual del mercado de azúcar, por Dr. J. A. Cerro, Secretario Ejecutivo del GEPLACEA, y una cuenta de la política actual para la cosecha de caña de 1988 en la Argentina, por Sr. R. Entrena. Sesiones técnico-agrícolas e industriales tuvieron lugar separadamente de una reunión en conjunto para escuchar un discurso del Dr. James E. Irvine sobre "Biotecnología en la industria azucarera".

La primera sesión agrícola comenzó con una discusíon sobre la roya por un panel dirijido por los doctores W. M. da Silva y H. Tokeshi, de Brasil, y Jorge A. Mariotti y Nilda Ramallo de la Estación Experimental Agro-Industrial Obispo Colombres en Tucumán. En seguida, hubo una presentación por Dr. da Silva sobre la epidemiología del carbón culmícolo de la caña de azúcar, y un examen de los avances tecnológicos en la cosecha y tranporte mecanizados, por Dr. A. L. Fors de los E.E.U.U. Un segundo panel de discusión, dirijido por los Srs. Hinojo, E. Pérez, M. van Balem y J. M. García González, discutió el tema de la productividad en la industria de la caña de azúcar, despues de lo cual Dr. Y. Masuda habló del mejoramiento de la caña de azúcar.

En las sesiones industriales, se presentaron trabajos sobre el uso de bagazo como materia prima para la fabricación de papel de periódico (por Dr. E. Fiallo), y la producción de aldehidos a partir de nafta y alconafta (por Dr. C. Gotelli). Dr. Herly Noa, del GEPLACEA, presentó un trabajo sobre la diversificación industrial mientras que Dr. S. Moreno discutió en detalle la optimización microbiológica de la industria azucarera, después de lo cual Sr. Fernando Cordovez describió el uso de tachos a vacío para cocción contínua de masas cocidas.

El programa industrial continuó el segundo día de la reunión con presentaciones sobre tecnologías modernas en el intercambio de calor, por S. M. Buela, y sobre mazas para molinos de caña, por Sr. J. Fariñas, mientras que Sr. Cordovez concluyó la sesión con una presentación sobre la fabricación de tablas de bagazo en Venezuela.

La sección agrícola de la Sociedad tuvo una sesión el segunda día en la que se discutieron varios factores que influencian la productividad de la caña de azúcar. Del panel, Dr. Irvine discutió la planta de caña de azúcar, Dr. Fors discutió la mecanización de la caña, Dr. A. Celso Sturion del GEPLACEA examinó la situación de América Latina, y Dr. M. Tullio de Brasil discutió el valor económico de variedades de caña de azúcar.

Después de la Conferencia, se organizó una visita a la Estación Experimental Agro-Industrial Obispo Colombres, dirigida por Dr. Mariotti, donde se encontraban para la inspección trabajos actuales que se agregaban a la historia célebre de investigaciónes agrícolas e industriales realizadas allí desde 1914.

Aspectos prácticos del control de dextrana en Atlantic Sugar Association*

por José F. Alvarez y Héctor Cardentey
(Atlantic Sugar Association, Belle Glade, Florida, EE.UU.)

La Atlantic Sugar Association es un ingenio localizado en el estado de la Florida, 15 millas al este de la ciudad de Belle Glade. Tenemos una tasa nominal de molienda de 10,000 toneladas diarias y una producción total promedio de 1,100,000 toneladas de caña de azúcar.

Nuestra operación de cosecha se compone de caña cosechada a mano y mecánicamente; un 70% de la caña se corta manualmente. El corte de la caña se realiza durante las horas del día, almacenándose suficiente caña para moler durante la noche. La caña se almacena en trailers de 20 tons en un patio descubierto, donde la caña es manipulada por tractores con cuchara frontal ("payloaders").

En 1981 la Atlantic Sugar Association, al igual que el resto de la industria azucarera de la Florida, afrontaba el problema del control de la dextrana. Las refinerías comenzaban a imponer multas a los azúcares con altos niveles de dextrana. La alta incidencia de multas fué lo suficientemente significativa como para llamar la atención de todos los productores del área.

Nuestra primera reacción fué revisar los trabajos realizados sobre dextrana. Encontramos que la dextrana es un polisacárido que resulta de la descomposición del azúcar en presencia de un micro-organismo que casi siempre es *Leuconostoc mesenteroides* Este micro-organismo está siempre presente en el medio ambiente, y prospera en condiciones húmedas y temperaturas medianamente cálidas.

La mayoría de las investigaciones realizadas parecían indicar que el grado de deterioro de la caña se debía principalmente a la quema de la caña y las condiciones climáticas (Figura 1), a la longitud del trozo de caña (Figura 2), y al tiempo transcurrido entre la quema, cosecha y molienda (Figura 3).

Resumiendo los resultados de las investigaciones previas, tenemos:

A. La quema y condiciones climáticas afectan el deterioro de los tallos de caña de azúcar.

B. La longitud del trozo y condición de la caña influyen en la tasa de deterioro.

C. Mientra más tiempo quede expuesta la caña después de la quema, mayor será su grado de deterioro.

Los resultados anteriores nos condujeron a establecer tres parámetros críticos: (1) condición de la caña, (2) medio ambiente, y (3) tiempo transcurrido entre quema y molienda.

Pensamos entonces que controlando estos parámetros críticos, podíamos controlar la dextrana. Se encontró que los tallos enteros y sanos

* Este artículo recibió el Premio George Samuels cuando fue presentado al Seminario Inter-Americano de la Caña de Azúcar en 1987.

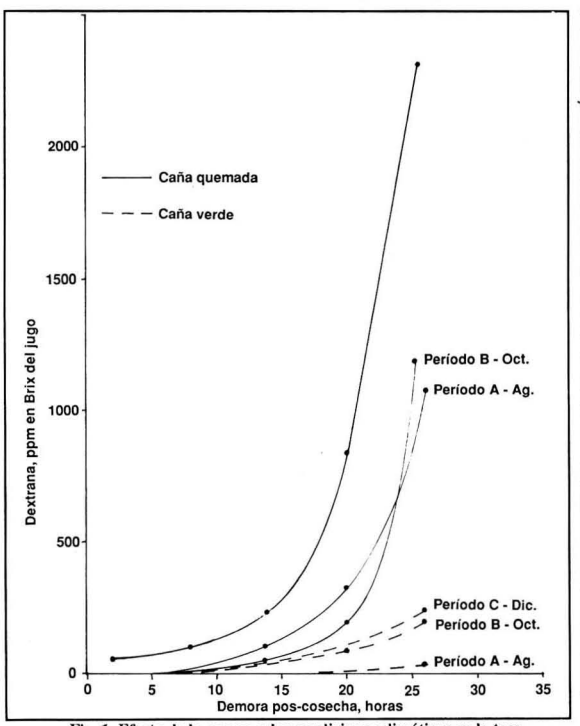

Fig. 1. Efecto de la quema y las condiciones climáticas en la tasa de deterioro de caña troceada

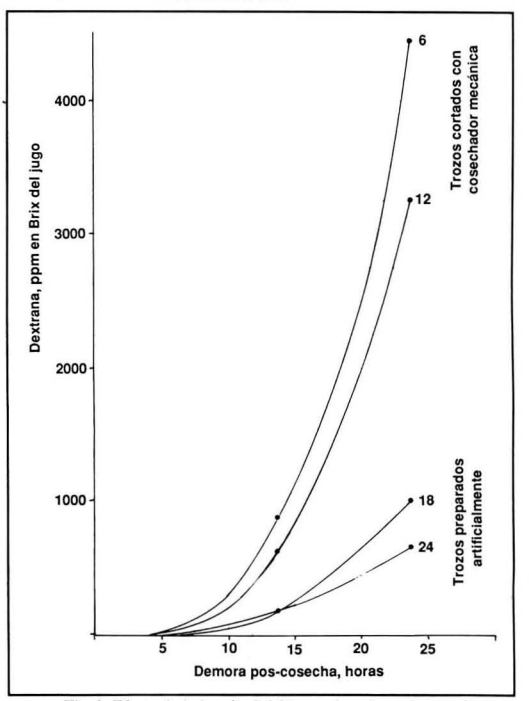

Fig. 2. Efecto de la longitud del trozo de caña en la tasa de deterioro de la caña quemada. Puntos de la curva son medias aritmeticas de 25 determinaciones hechas del 2.9.71 al 13.12.71

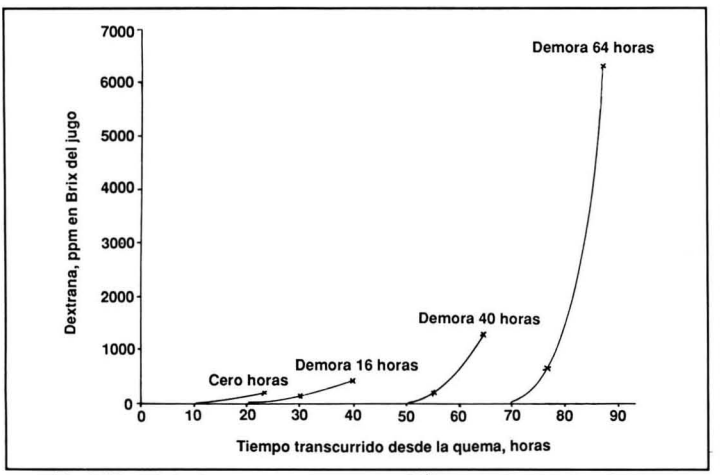

Fig. 3. Efecto de las demoras entre quema y corte (Q/C) y entre el corte y la molienda, en la tasas de deterioro de la caña troceada

no contienen dextrana. Es solo después que se queman, que comienza la formación de dextrana. Esto indica que al destruirse la cubierta protectora de cera durante la quema, el micro-organismo puede entonces penetrar la epidermis del tallo. La longitud del trozo de caña es también un factor. A mayor área expuesta, más rápidamente se deteriora la caña y consecuentemente, más alto el nivel de dextrana en la caña.

Las condiciones ambientales son también un factor importante. El tiempo tibio, la humedad relativa alta y la lluvia, son condiciones ideales para la reproducción del micro-organismo. Se encontró que la caña expuesta a este tipo de condiciones tenía niveles más altos de dextrana.

El tiempo transcurrido entre la quema y la molienda, resultó ser también un parámetro importante. Mientras más tiempo se dejaba la caña en las condiciones mencionadas, mayor el nivel de dextrana, lo que resulta lógico, ya que los micro-organismos sintetizan la dextrana a un tasa geométrica de incremento.

Cambios efectuados en Atlantic Sugar Association

Una vez identificados lo que creímos eran los parámetros críticos, el siguiente paso fué realizar los cambios necesarios en nuestras practicas agrícolas y de fábrica, para reducir al mínimo la formación de dextrana. Los cambios implementados fueron los siguientes:

A. En el corte manual, quemar solamente la superficie que pueda ser cortada en las siguientes 24 horas.

B. En el corte mecanizado, quemar solo la caña que se cosechará el mismo día.

C. Posponer la quema de la caña cuando exista la posibilidad de que pare la fábrica debido a tiempo inclemente.

D. Mantener afiladas las cuchillas de las cosechadores y cargadores, para evitar el desgarre de los tallos y daños a la cepa.

E. Reducir el volumen de caña almacenada en tongas y mantener éstas el menor tiempo posible.

F. Almacenar en tongas solo la caña cortada manualmente, ya que ésta so compone de trozos más largos que los cortados mecánicamente.

G. Instale un aditamento trasero en los tractores con cuchera frontal que manipulan la caña en el patio, para impedir que éstos aplasten la caña tirada en el suelo al retroceder.

H. Moler la caña por orden de llegada.

I. Determinar el tiempo óptimo entre quema y molienda de la caña cortado a mano, así como de la cortada mecánicamente.

J. Realice diariamente determinaciones de dextrana para obtener datos que permitan nuevos análisises e identificar el nivel de dextrana en los azúcares.

K. Mantener desinfestada toda la superficie de almacenaje de la caña.

L. Mantener limpios los conductores y trapiches usando vapor y agua caliente.

M. Agregar un surfactante a la corriente de melaza "B", para evitar viscosidades altas.

N. Evitar tiempos largas de retención de jugo mezclado y crudo en los tanques de jugo y los tanques de maceración.

O. Identificar y llevar un registro de los niveles de dextrana en el azúcar almacenada, para efectuar futuras mezclas.

P. Determinar los niveles de dextrana en el jugo crudo, el jugo diluído, el jugo clarificado, el sirope, la melaza y los azúcares.

Resultados y conclusiones de la experiencia de Atlantic

Todos estos cambios fueron implementados y al cabo de varias zafras de recopilación de datos y experiencias, llegamos a los siguientes resultados y conclusiones.

A. Se redujo el nivel de dextrana en los azucares en un 300%.

B. El tiempo óptimo de entrega de la caña resultó ser 40 a 48 horas para la caña cosechada mecánicamente y 60 a 72 horas para la caña cortada manualmente.

C. Con temperaturas en el rango de los 80°F y humedades altas, se vuelve más crítico el tiempo de entrega.

D. La caña almacenada en trailers tiene niveles más inferiores de dextrana que la caña almacenada en el patio de caña.

E. Al reducir el tiempo que la caña permanece en el patio, se reduce la formación de dextrana.

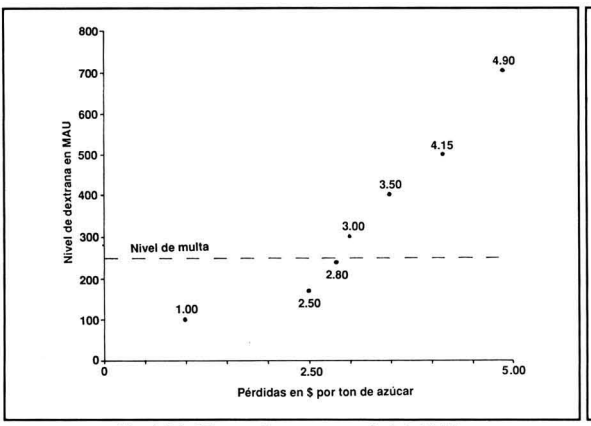

Fig. 4. Pérdidas por dextrana para nivel de MAU

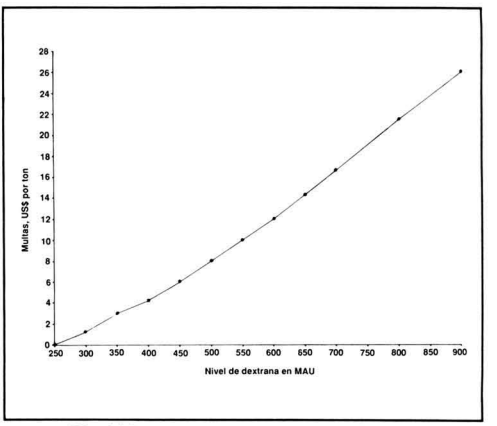

Fig. 6. Multas por dextrana en azúcares, $ por ton

F. La dextrana se forma en la caña. Una vez ésta entra al proceso, no se generan cantidades significativas. No existe evidencia de que la dextrana se destruya durante el proceso; en su mayor parte queda en la cachaza, la melaza y los azúcares.

G. Las pérdidas en azúcar recuperable que se transforma en dextrana, son significativas.

Sabemos que la caña sana no contiene dextrana. Como determinamos los niveles de dextrana en el jugo extraído, hemos calculado las pérdidas en azúcar en el período transcurrido entre quema y molienda.

La Figura 4 muestra que las pérdidas de azúcar, asumiendo un precio de 18 centavos por libra, pueden ser substanciales para niveles de dextrana superiores a 500 MAU. Aunque las multas comienzan a aplicarse a 250 MAU, las pérdidas de azúcar recuperable a este nivel, son ya de $2.90 por tonelada de azúcar, sumado a que las multas acutalmente impuestas al azúcar, pueden resultar en pérdidas substanciales de dólares (Figura 5).

Como puede apreciarse en la gráfica (Figura 6), la curva de multas es parabólica. Esto significa que las sanciones se aceleran a medida que los niveles de dextrana aumentan. De nuevo, asumiendo un precio de 18 centavos la libra de azúcar, las multas en un cargamento de 20,000 toneladas pudieron totalizar $56,800 para un nivel de 350 MAU en el azúcar, y tanto como $194,000, para niveles de 580 MAU.

Aparte de las pérdidas de azúcar (desde el momento en que la caña se quema y muele y las pérdidas por multas), la dextrana puede afectar la cristalización y purga de las soluciones azucaradas. Calculamos que las pérdidas totales en rendimiento, azúcar recuperable, y producción, ameritan prestarle inmediata atención a todos los niveles de la operación cañera.

Con el propósito de mostrar más objetivamente el impacto de la dextrana en el rendimiento, hemos trazado una curva con los datos de rendimiento y contenido de dextrana en relación a días de zafra. La conclusión más significativa a que podemos llegar en base a los días de zafra seleccionados, es que cuando el nivel de dextrana en el azúcar alcanza los 600 MAU, el rendimiento habrá bajado en un 10%. Esto ilustra la importancia de controlar la dextrana en el azúcar.

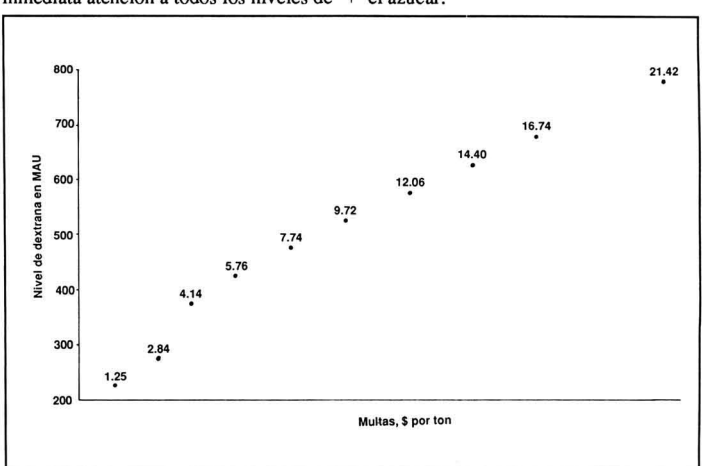

Fig. 5. Multas por dextrana en azúcar

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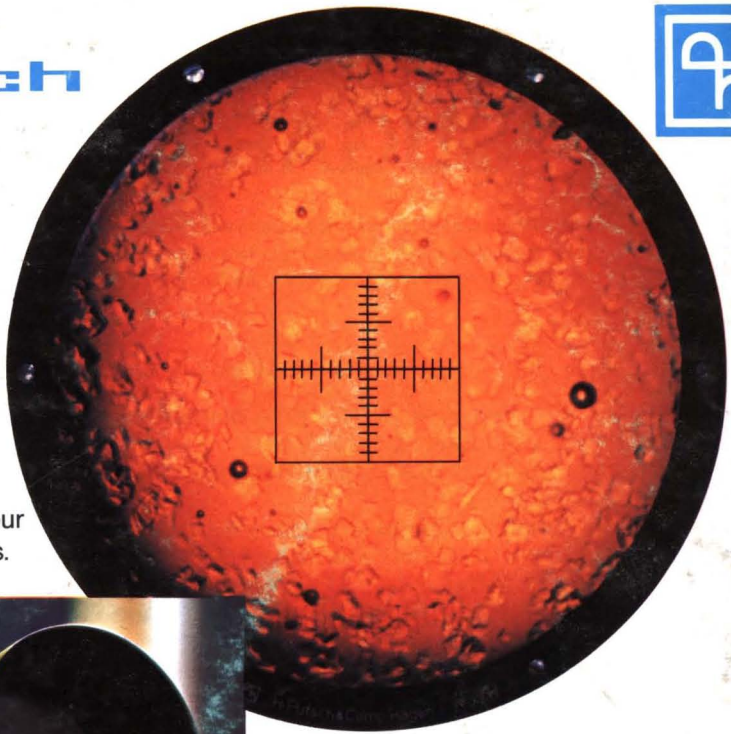

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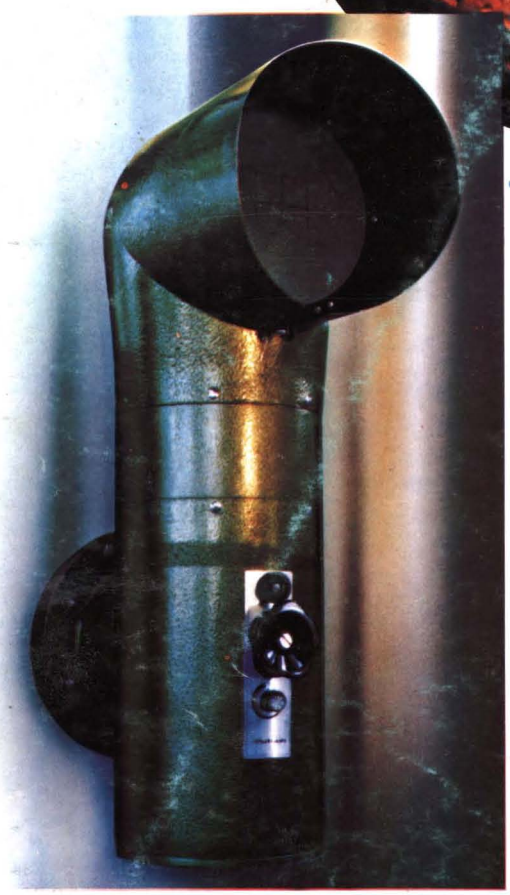

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