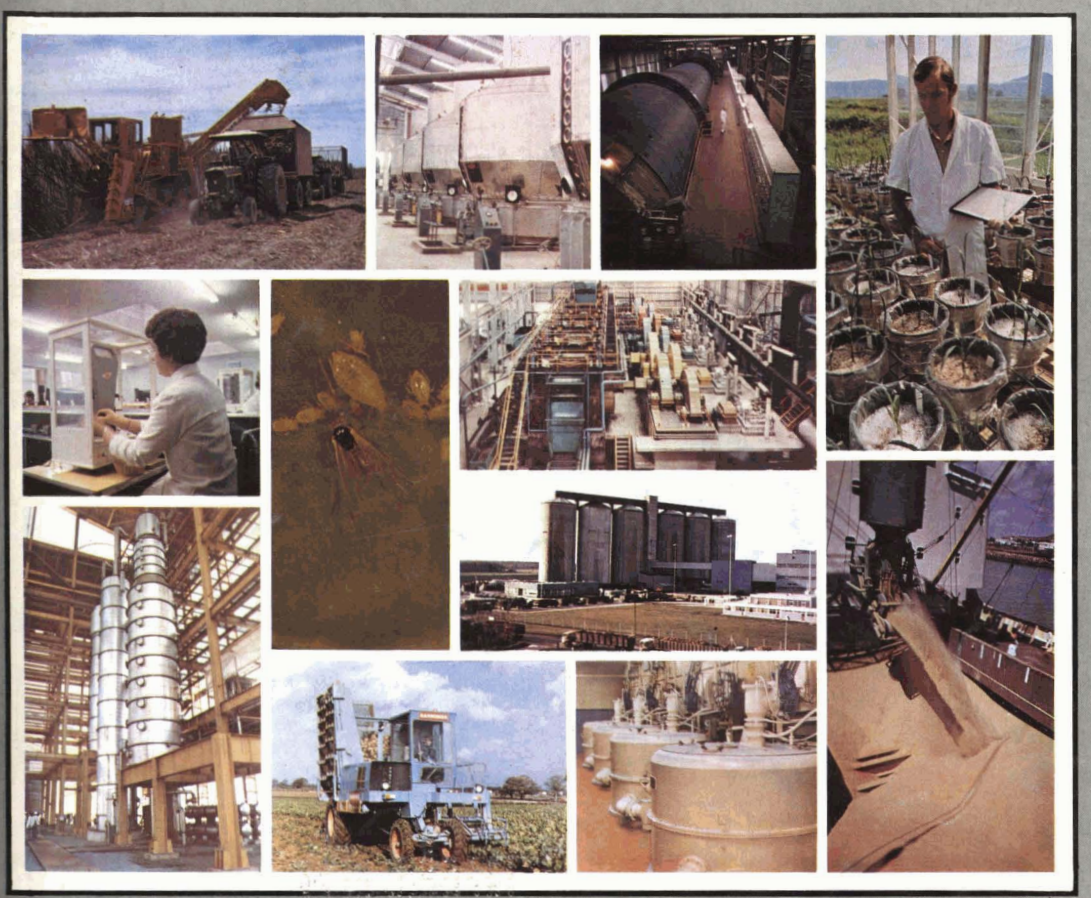
INTERNATIONAL SUGAR JOURNAL

VOLUME LXXXIV

ISSUE No. 998



FEBRUARY 1982

From raw sugar to sparkling white crystals Norit leads the way.

NORIT® is the standard for decolorizing in world sugar refining.
Small wonder: Norit has over 60 years experience in producing activated carbons best suited for decolorization and purification of sugars.
Norit helps when it comes to the design of the adsorption system that fits best in your particular case.
Besides Norit supplies installations for handling and dosing powdered carbon and for reactivating granular carbon.

Always consult Norit.

Ask for documentation:

NORIT

Norit n.v. P.O. Box 105,
3800 AC Amersfoort
The Netherlands,
Phone 33-30454, Telex 79040

Sales Offices:
Glasgow (U.K.), Düsseldorf (G.F.R.),
Milan (Italy), Paris (France)
Jacksonville, FL (U.S.A.).

Editor and Manager:
D. LEIGHTON, B.Sc., F.R.S.C.

Assistant Editor:
M. G. Cope, M.I.L., M.T.G.

UK ISSN 0020-8841

Annual Subscription:
£30.00 post free

Single Copies:
£3.00 post free

Airmail charges
quoted on request to

The International Sugar Journal Ltd.,
23A Easton Street, High Wycombe,
Bucks., England HP11 1NX

INTERNATIONAL SUGAR JOURNAL

Volume 84
Issue No. 998

CONTENTS February 1982

Printed by the Wrightsons Group of Companies, London; and published by the Proprietors, The International Sugar Journal Ltd., at 23a Easton Street, High Wycombe, Bucks. Entered at the New York Post Office as Second-Class Matter.
PRINTED IN GREAT BRITAIN.

Published by
The International Sugar Journal Ltd.
23A Easton Street,
High Wycombe, Bucks.,
England HP11 1NX.

Telephone: 0494-29408 *Telex:* 21792 REF 869

Inquiries regarding advertising should be addressed to the above office or to the appropriate representative:

France: MaG-Watt International,
6 rue des Acacias, Vert-le-Grand, 91810 Essonne.
Tel.: 492-00-15.

Holland: G. Arnold Teesing B.V.,
Prof. Tulpstraat 17, 1018 GZ Amsterdam.
Tel.: 020-263615. *Telex:* 13133.

India and South-East Asia:
J.P. Mukherji & Associates Pvt. Ltd.,
P.O. Box 915, Poona, India 411 005.
Tel.: 52696/7 *Cable:* Preproject, Poona.
Telex: 0145-367 JRMASSO.

Japan: Shinano International,
Akasaka City Plaza No. 304, 8-1 Akasaka 1-chome, Minato-ku, Tokyo 107.
Tel.: (03) 584-6420.

U.S.A.—Florida and Latin America:
Mr. Mario A. Mascaró,
7321 S.W. 82nd Street No. 1, Miami, FL, U.S.A. 33143.
Tel.: (305) 667-1724.

NOTES AND COMMENTS

World sugar prices

Very quiet conditions prevailed at the beginning of December and the London Daily Price for raw sugar, which started the month at £159 per tonne, dipped on one day to £155 but recovered the next and gradually rose to £163 by December 10. The news that Australia had sold its first cargo of raw sugar since 1974 to the Soviet Union brought an improvement to £169 and the price stayed between £168 and £172 until December 22, perhaps influenced by the news of the imposition of martial law in Poland.

Reports of a disappointing start to the important Thailand sugar season, lack of supplies from the Philippines and settling of the US sugar policy all contributed to a rise in the LDP on December 23 to £176 but confidence evaporated after Christmas and the price ended the month at £167 per tonne.

White sugar values moved similarly to those of raw sugar and, from an initial level of £166 per tonne, the LDP(W) rose to £173.50 on December 11, falling to £170 two days later and then rising to £175 on December 17. It reached a peak of £180.50 on December 23 but then fell, ending the month at £171.50. From a premium of £7-8 at the beginning of the month, this fell to nil on December 15 but rose again to between £3 and £5.50 during the second half of the month, reflecting the ready availability of white sugar.

The EEC and the ISA

Following indications at the November 1981 meeting of the International Sugar Council that the EEC observer had the authority to examine possible arrangements under which the Community might adhere to the International Sugar Agreement, a formal meeting was arranged between the representatives of the Council and the Community on December 8. The EEC representative was asked to provide more detail on the attitude of the Community and to indicate changes which would be required in the Agreement to enable adherence to it by the EEC. This he did; some changes were considered possible but others would require renegotiation and could not be effected during the life of the current Agreement, now extended to the end of 1984. It would seem unlikely, therefore, that the EEC could become a member; however there is great scope for cooperation and further meetings were expected to be arranged early in 1982.

US Farm Bill

As indicated earlier[1], continuing hostility to the 17.5 cents/lb proposed sugar support level resulted in a further reduction when the Joint Congressional Conference reconvened after its Thanksgiving recess. A new compromise plan, involving a level of 17.0 cents for 1982, with a reduction to 16.5 cents/lb if world sugar prices fall below 10 cents/lb in the last ten days of the 1981/82 season before the next begins on October 1, was approved narrowly by the Committee. It then passed through the Senate and the House of Representatives and was signed into law by the President on December 22.

The duty on sugar imported into the US was increased from 0.625 cents/lb to its maximum level of 2.8125 cents and the import fee raised from 1.53 cents to 2.1418 cents/lb, the new levels to operate during the first quarter of 1982.

Affected parties have denounced the Bill; farming interests and domestic sugar producers consider the support inadequate, while overseas raw sugar suppliers and refiners consider that the Bill's provisions will result in a continuation of the decline in US consumption, so offering less of a market for sweeteners, while corn-based syrups producers will be encouraged to penetrate the market more deeply, to the detriment of sucrose. Finally, the consumers will be paying a higher price for their sugar than they would have been in the absence of the Bill. Like most compromises, the Bill is one which leaves everyone disappointed.

Indian sugar industry expansion[2]

The sugar industry of India is one of the scheduled industries under the Industries Development and Regulations Act of 1951. Ever since the era of planning began in 1951, the government of India have been laying down targets for capacity and production of sugar; in order to achieve these targets and to ensure a balanced and planned development of the industry, the establishment of new capacity has been subject to government approval. In 1980, the government issued guidelines for the licensing of new sugar factories during the Sixth Plan Period. Similarly, guidelines have been prescribed for the expansion of capacity of existing facilities. Despite the relatively strict control the licensing provisions have been liberalized from time to time. Various scheduled industries, including the sugar industry, were permitted by the government to extend capacity with a capital investment of up to Rs 30 million without government approval.

On August 18, 1981, however, the Indian government decided to end the liberalized licensing policy for the sugar industry. The government had good reasons to change its policy since, under the liberalized procedure, the principles of the controlled expansion of the industry were being undermined, especially by the cooperative sector. Instances were not lacking where cases seeking expansion which were rejected by the Licensing Committee were implemented by certain cooperative factories taking advantage of the liberalized licensing procedure. Under these circumstances the government had no other option than to end the policy.

The government had also decided to expand markedly the capacity of the Indian sugar industry. In view of the crisis faced in the 1980/81 crop, the government is trying to expedite licensing of new sugar factories in order to raise the installed capacity of the industry. The total licensed capacity of the industry is currently 7,718 tonnes, tel quel, while the installed capacity is 6,337,000 tonnes, tel quel. Ever since licensing was revived in July of 1980, about 18 licenses for new factories have been recommended. However, total sugar production in 1980/81 is estimated at 5,150,000 tonnes, tel quel (5,600,000 tonnes, raw value) reflecting under-utilization of capacity to the extent of 18%.

According to the Sixth Plan projections, the licensed capacity required during 1981/82 would be 8,042,000 tonnes, while the installed capacity should be 7,010,000 tonnes. Steps are therefore being taken to speed up the process of licensing for new factories since the installed capacity is lagging behind the actual requirements of the

[1] *I.S.J.*, 1982, **84**, 2.
[2] F. O. Licht, *International Sugar Rpt.*, 1981, **113**, 624-626.

industry. As a result of these measures there was a sizeable increase in the licensed capacity from 7,289,000 tonnes to 7,718,000 tonnes, tel quel, between the beginning of the 1979/80 sugar season and July 31 last year.

By the end of the Sixth Plan Period it is anticipated that sugar production will rise to 7,640,000 tonnes. The installed capacity of the industry is also planned to be increased to 8,042,000 tonnes while the licensed capacity would be about 9,621,000 tonnes. These projections take into account commitments to export about 1,000,000 tonnes of sugar annually during the next four years. While exports are expected to remain static at this level, domestic requirements are expected to rise from 5,600,000 tonnes this year to 6,640,000 tonnes by 1984/85. This also assumes a per caput consumption of 9.196 kg per year by the end of Sixth Plan Period. But during 1980/81 the per caput consumption of sugar was only 7.5 kg as against the target of 7.979 kg. Official sources, however, feel that if the production capacity is raised substantially, the consumption target may yet be achieved, especially since, in the first year of the plan period, the sugar economy was recovering from a very severe setback and a judgement could not be made on the basis of that year's performance.

These plans seem to be rather ambitious and involve a total capital cost of over Rs 8000 million at current costs. The government has further proposed to distribute additional capacity between new units and expansions in the ratio of 60:40. Earlier emphasis was placed on expansions which accounted for 60% of new capacity. According to the Indian Sugar Mills Association there is no justification for the reversal in the ratio which would involve delay in the establishment of new capacity and additional capital investment because expansions are less costly and less time-consuming. The Association takes the view that the distribution of new capacity between expansion and new units should be in the ratio of 75:25. This would reduce the cost of establishing new capacity by about Rs 1300 million.

A review of the sugar situation would not be complete without a discussion of the free sale price trends. Ever since the government announced its decision to import sugar in the last week of June 1981 free sugar prices have declined progressively by as much as over Rs 200 per quintal. This has created serious difficulties for the industry which finds it difficult to discharge its obligations and repair the plant and machinery. On the other hand there is no sign that the Indian government will change its policy of ensuring relatively low sugar prices. In the long run a balance must be found between the interests of consumers and the industry. Production will be adversely affected in the longer term if the industry does not make adequate profits.

Brazilian fuel alcohol program delay[1]

A shortage of government funds has forced Brazil to put back its ambitious alcohol-from-cane program by up to two years, according to the country's industry minister. Originally the authorities hoped to produce 10,700 million litres of alcohol a year from sugar cane and other products by 1985 but now the minister says this target will not be reached until 1987 or, at a pinch, 1986. Brazil has pioneered the production of fuel from vegetable matter but, cash problems aside, there is mounting evidence that it is not the panacea its advocates suggested.

The sugar into alcohol program began in 1975 and is designed to supply alcohol for automobiles to economize on crude oil imports. Some 500,000 alcohol-fuelled cars have been sold so far out of the total 8 million private cars in Brazil.

The postponement of the 1985 target will not come as much of a surprise to observers of the alcohol program. General Motors and Fiat in 1981 removed the 10% premium on alcohol-powered cars initially imposed to curb rising demand, because of recent consumer resistance to fuel alcohol. Drivers found that at least a fifth more alcohol was needed to travel the same distance as with a petrol-powered car and there were worries about cold starting, corrosion and resale values. In July 1981 only 3000 alcohol-powered cars were sold out of a total of 40,000, against a peak in December 1980 of over 49,000. Meanwhile, would-be owners were being asked to pay 10% more for an alcohol-powered car than an ordinary one.

The alcohol production target for 1980/81 of 3670 million litres was missed by 230 million litres and, in March 1981, as a temporary measure, the Brazilian government turned down 1000 applications by garage owners wishing to install alcohol pumps. The percentage of alcohol mixed with petrol was reduced from 20% to 5%.

The majority of Brazil's alcohol – about 70% – is produced in the state of São Paulo. It is estimated that about 2,000,000 tonnes of the 8,200,000 tonnes sugar crop is used. In 1981/82 Brazil hopes to produce about 4300 million litres. Although the cold snap at the end of July 1981 damaged the cane, alcohol output is unlikely to be seriously affected as frost-damaged cane can more readily be used for alcohol than sugar production.

The sugar market in 1982

Writing at the end of 1981, E. D. & F. Man consider[2] that "the coming weeks should see a substantial clarification of the position in the two major areas of uncertainty, which have affected the world market in recent months. First, the complex question of the E.E.C. stockpiling plan should be largely settled by the end of January, when producers must finally commit themselves on C-quota tonnage to be carried forward. Before long the beet area for 1982/83 should also become a serious market factor. The second area of uncertainty in recent months has been the U.S.A. With recent legislation, it is hoped the situation here will improve as both final buyers and traders regain the confidence and certainty to engage in meaningful trading for forward delivery.

"The outlook for price in 1982 is reasonably well balanced at this stage: recent low prices will undoubtedly result in production cutbacks in the EEC although the extent of this reduction is yet to be seen, and the majority of cane producers will encounter great difficulties in increasing production at current levels. It may also be hoped that the rate of High Fructose Corn Syrup substitution will be slowed by low sugar prices, although in the U.S.A. the new support levels of over 19 cents per pound may eventually serve to encourage alternatives to sugar. Low prices should also encourage consumption growth.

"To conclude, 1982 should see a moderate increase in consumption with the prospect of a reasonably balanced 1982/83 supply/demand picture. This should prove sufficient to hold prices in the recent trading range of 12-14 cents/lb and, possibly, to provide a basis for a gradual improvement in price during the coming year."

[1] *Public Ledger's Commodity Week*, November 14, 1981.
[2] *The Sugar Situation*, 1981, (347).

Safe and economical use of anti-foam agents in beet sugar factories*

By J. TJEBBES
(Svenska Sockerfabriks AB, Sweden)

Foaming can occur in several parts of the sugar manufacturing process and it is always a nuisance. The prevention and inhibition of foaming costs large amounts of money and also creates other problems. This is especially true when modern anti-pollution regulations have required more closed systems for condenser and transport waters. On the other hand, modern chemistry has created anti-foam agents that are much more powerful than earlier types, and we have also learned how to use them in better ways.

Foam is generally considered to be stabilized by the presence of one or more of the following four types of compounds, viz:

(1) Surface active substances (tensides).

(2) Substances creating liquid crystalline phases.

(3) Macromolecules, such as proteins.

(4) Particles of a defined size.

Anti-foam agents can act either as foam breakers or as foam preventers, and they can be considered as doing so by one of the following four mechanisms:—

(a) lowering of the surface viscosity, which can be achieved by large special molecules such as triborylphosphate;

(b) creation of a concentration gradient as when spraying alcohol or ether on the foam;

(c) changing the solubility of the foam maker by solvents or by altering the pH; or

(d) spreading of a film onto the foam lamellae.

Silicone oils work by mechanism (d) as also do many mineral oils and animal fats.

Taking into consideration all the possible combinations and the variations within the groups, one is not surprised at the large number of commercial anti-foam agents and the consequent difficulties in selecting the correct one for a given application. It must always be remembered that in most cases there is a mechanical cause for the foaming. It is thus always worthwhile considering whether or not the foam problem can be reduced simply by preventing leaks at pump shafts or other similar means. The shape and surface structure of the jets used in fluming are of fundamental importance for foaming in that area. In one Swedish sugar factory, foaming in the extraction decreased when a new scalding trough was installed.

J. Tjebbes

Obviously, however, the foaming in a sugar factory cannot be completely removed by physical changes to equipment so we have to rely on anti-foam additives. When introducing additives into a process one must always pay attention to the fact that what is introduced must end up somewhere, and might constitute a risk for the environment or for the consumer of sugar products. The additive also has to be handled by factory workers and might create a health risk for them.

The sugar industry is not alone in being aware of the different risks, although it is quite often left on its own when seeking to minimize them. There are a variety of regulations to be considered, the best-known being the US F & DA rules and the German food legislation. Both sets of rules concern only the health of the sugar consumer and are based on the assumption that the added defoamer must not be found in the sugar. It therefore caused some discussion, especially in Germany, when we showed at the CITS meeting in Amsterdam in 1979 that, using modern analytical techniques, defoamers can be shown to remain in white sugar. The concentrations found were very small indeed and cannot by any means be considered as dangerous. Personally, I feel more comfortable at being able to state that traces of defoamer can exist in sugar, and declare the precise amount, rather than accept statements from the producers of anti-foam agents that their products do not end up in the sugar.

I will try to demonstrate that proper consideration of those responsibilities might well be combined with good economy. Costs of anti-foam agents in this paper are given as Pounds sterling per metric tonne of sugar produced. Those who prefer costs per tonne of beet can apply a factor of 0.15. Prices of chemicals are, however, difficult to compare from country to country and from one year to another, so the figures given should only be used for relative comparisons.

Fluming and washing

Large amounts of foam are caused by the high velocities and the high impact forces in the flumes and by the turbulent movement in the beet washer. The foaming compounds are saponins and proteins from the beet and other material from the soil. The foam is also stabilized by particles from the dirt. A decantation system which is operating well will reduce foaming considerably, as will the use of a flocculant. pH is of major importance, so liming will also reduced the foaming. To reduce foaming purely by mechanical means is difficult, although some consideration should be given to the design and the method of use of the Elfa guns.

As a matter of fact, modern technology has increased the foaming dramatically by introducing enclosed return water systems, thereby increasing the amount of circulating foaming components. Unfortunately, as will be shown later in this paper, the anti-foam agents, because of their nature, do not circulate but are rather removed with the mud. More anti-foam agents must therefore be added continuously.

* Paper presented to the 25th Tech. Conf., British Sugar Corporation Ltd., 1980.

In the 1960's the most commonly used anti-foams were based on waste products from different oil or fat producing sources. Typical components were various mineral oils and animal fats. The products were often cheap, which was thought to compensate for their rather low efficiency. They all worked by the mechanism of spreading a film.

In 1967 a new anti-foam agent was offered based upon alkoxane ethers of fatty alcohols. The price for the new product was higher by a factor of 2.5. The toxicity was much lower, with an LD_{50}-value of 5 g/kg. Our first test with 200 kg showed a decrease in quantity much greater than 2.5, so a bigger test was run for about one month in one factory. This test was also favourable, so in the following campaign three of our factories used this new synthetic product. In Table I is shown the cost of anti-foam agents in tests in our factories in different years and including the two years 1967 and 1968. The good economy of the new product is obvious. The total amount of anti-foam material pumped out with the mud was also reduced to about one third, which was quite an achievement from the anti-pollution point of view. The alkoxane ethers are also much easier to degrade naturally and less toxic to wild life.

Table I. Costs of anti-foam agents in the fluming system

	£ per tonne sugar					
	1966	1967	1968	1969	1978	1979
Main component						
Wool fat + mineral oil	0.049	0.044	0.047	–	–	–
Silicone	–	–	0.076	–	–	–
Vegetable oil + esters	–	0.080	0.086	0.088	0.90	0.89
Alkoxane glycol	–	–	0.039	0.035	0.71	0.49
Alkoxane + mineral oil	–	–	0.047	0.037	–	–
Alkoxane + fatty esters	–	–	–	–	0.63	0.41
Price index	96	98	100	103	550	649

In the following years competition brought forward products that, simply speaking, can be characterized as mixtures of the mineral oil products and the new synthetic materials, which were even more cost-effective. Increasing concern about pollution, however, made us ask the producers to deliver anti-foam agents containing no mineral oil whatsoever. They then explained that the mineral oil had to be replaced by vegetable oils which at that time cost more. We insisted, and set up a time limit beyond which we would not buy any anti-foams containing mineral oil. This was announced in 1976 to be valid in 1978.

We were immediately offered two products from different manufacturers, which they apparently had kept secret until put under pressure. By 1978 the new line of anti-foam agents for the water system was further improved as can also be seen from Table I.

Therefore, we have now available several rather cost-effective anti-foam agents for this part of the process. The next step for reducing costs must be to look into the way the anti-foams are used, and especially how the amounts are controlled. Although more cost-effective, the new products cost much more per kg, and so any wasteful use must be avoided. The normal arrangement includes one or several pumps with variable delivery gates. When the operator finds it necessary, he increases this rate by pushing a button or rotating a screw. Usually this control is positioned so that it is somewhat difficult to reach, presumably hoping that it will not be used very often. But the effect is that the delivery rate is of course raised when it is needed but it is very seldom lowered until observed by the shift superintendent.

We have in the last two years tried two different solutions of this problem. In one factory a duplicate control for the anti-foam pump was installed in the control room and from there the situation can be watched by closed circuit television. Very favourable experiences by this system are reported, but we have not made any systematic study of the effect.

Another arrangement is to install two pumps on the same line. Pump No. 1 is normally operating alone and the setting can only be adjusted by the shift superintendent. Pump No. 2 can be started by the operator but only via a time relay that will stop the pump after a preset time interval, say 15 minutes. This has been tested by us with apparently good results, but so far we have no permanent installation.

Extraction

The next process step requiring anti-foam agents is sugar extraction. In Sweden we have towers and DDS troughs but no RT diffusers, and the latter probably create less foam than the others. The DDS diffuser is also very sensitive to foaming and not only is the extraction reduced, but the transport of the cossettes is hindered by foam. The juice then goes to the liming and the carbonatation, but additional anti-foam is rarely needed here, as the amount added in the extraction is normally sufficient also for the defication.

Many producers of anti-foam agents claim that their products are completely eliminated in the sludge. We had serious reasons to doubt this in the 1960's. One of our factories producing raw sugar, which used a wool-fat and mineral oil-based anti-foam, showed severe carbon deposits in the boiler. In this factory, as in most Swedish ones, condensate from the evaporators is used as boiler feed make-up water. At that time we did not have the analytical methods for quantitative analysis. Qualitative tests, however, showed very clearly that oily components from the anti-foam agents were present in the condensate. We then made laboratory experiments which showed that more than 50% of the anti-foam passed into the thin juice and that 10% distilled over into the condensate. The remaining 40% passed into the thick juice and would thus end up in the raw sugar or in the molasses.

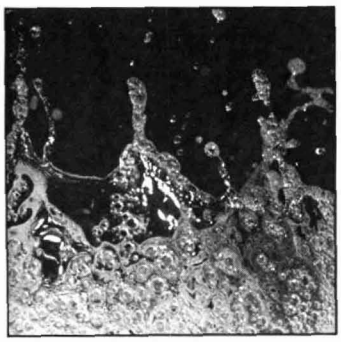
A decision was then taken to observe two properties of any anti-foam agent which was to be used "inside" the factory –

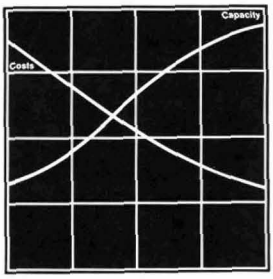
(1) it should be of very low toxicity, and

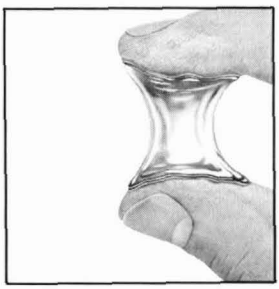
(2) it should not contain any steam-distillable material.

The same thing then happened as described for the outdoor anti-foams. The manufacturers first complained over our stubbornness and then started to deliver products which were far better than the previous ones. The new anti-foam agents contained fatty acid esters or alkoxane ethers of fatty alcohols often in combinations. We experienced a threefold price increase and a reduction of consumption averaging a factor of two, so the economy was not improved immediately.

A study of the methods of adding the anti-foam in the sugar extraction process revealed, however, many possibilities of decreasing the consumption. Normally an emulsion was made which was either pumped or dripped into various parts of the extraction system. But when a critical foaming situation developed, the normal practice was to take a bucket full of concentrated defoamer and







Hodag for Sugar Processing

Boost Sugar Production... Increase Efficiency... Reduce Operating Difficulties

With over 25 years of pioneering experience in the formulation and production of chemicals for the sugar industry, we can offer you proven, top-quality products, prompt service, and the technical know-how to meet your most demanding specifications.

Our modern technical facilities are equipped and staffed to produce the right product for your particular need. And, Hodag representatives are located in sugar producing countries around the world to provide any field support you may require.

Hodag Sugar Products can increase your sugar yield and solve your processing problems. Let us show you how.

Hodag products for the sugar industry include:

CB-6 Aids sugar crystallization and processing, improves quality, increases exhaustion of final molasses, and overcomes problems due to sticky, hard to handle massecuites.

VAP-99 Increases evaporator efficiency, saves energy, inhibits scale formation.

HCA-21 Inhibits scale in alcohol stills, evaporators, and heat exchangers.

FLOCS 411, 422, 433 Coagulants and flocculants for clarification of sugar juice.

RAPISOL Increases the penetration and cleaning efficiency of caustic soda.

PH-2 DESCALER Granulated acid cleaner for evaporators, pans, and heat exchangers.

FLO-1 Improves molasses fluidity for handling, storing, and clarification for fermentation.

SANITROL Reduces inversion losses, odors, and aids in overall mill sanitation.

ANTIFOAM BX-SERIES For beet sugar processing. Formulations for use with water or mineral oil.

Send the inquiry coupon below for samples, literature or to have one of our Technical Sales Representatives contact you.

Please send literature on the following Hodag products:

☐ Please send samples of the products indicated.
☐ Please have Hodag representative contact me.

Name _____ Title _____

Company _____

Address _____

City _____ State _____ Zip _____

Country _____

HODAG CHEMICAL CORPORATION
HODAG INTERNATIONAL S.A.
7247 North Central Park Ave., Skokie, Illinois 60076 U.S.A.
Telex: 72-4417 Telephone: 312-675-3950
HODAG EUROPE LTD.
86 Park Street, London W1Y 3HQ, England
Telex: 885482 Telephone: 01-409 0878

pour it into the trouble spot. Of course, the same bucket was used with the new expensive anti-foams. I think, on the whole, we have rather good working men in our factories, but nevertheless this bad habit was very difficult to change.

We therefore started to install more closed systems for making up and delivering the anti-foam emulsions to the extraction, and we put the drums with the undiluted anti-foam out of reach. This took several years but, as can be seen from Table II, the effect was obvious. Our costs for the anti-foam battle went down from 1968 to 1971, which period covers the development described.

Table II. Costs of anti-foam agent in the extraction

	£ per tonne sugar			
	1968	1969	1970	1971
Factory				
Hasslarp	0.059	0.059	0.062	0.061
Jordberga	0.070	0.071	0.070	0.075
Karpalund	0.051	0.051	0.049	0.055
Köpingebro	0.039	0.035	0.035	0.040
Mörbylanga	0.035	0.033	0.035	0.030
Roma	0.047	0.048	0.039	0.051
Ortofta	0.048	0.051	0.052	0.053
Price index	100	103	106	119

Sugar boiling

As we use very little anti-foam in evaporation, the next step to review is crystallization. Here the need for low-toxicity materials is obvious, and edible fats such as tallow are often used. A study of the foaming in the vacuum pans led us to consider alternatives to tallow. We found that, although heavy foaming can be a nuisance, a controlled foaming is essential for the process. The heat transfer leads to the formation of steam bubbles at the tubes. Both the heat transfer and the movements of the massecuite are very sensitive to the size of those bubbles. The size is a function of the overall viscosity, of the surface viscosity and of the surface tension. The defoamer plays a very important role in those properties and should be selected very carefully in order to optimize the heat transfer and the circulation.

We eventually found that a product containing alkoxane ethers of lauryl alcohol is very effective. It has also a very low toxicity and can be used safely in the A-strikes, although traces can be found in the white sugar. The same product also decreases the surface forces acting between crystals and syrup, thus helping in the crystallizers. This effect is often described as "lowering of viscosity", which is not quite correct as the viscosity of the syrup is hardly affected. Many products are marketed for this purpose, giving possibilities for substantial improvements in crystallization yields. We have not been able to obtain more than marginal effects.

We find, however, good effects of these defoamers in the centrifugalling, where low surface forces between crystals and syrup are essential.

Continuous centrifugals have a tendency to whip air into the molasses. This type of foaming is very irritating but can very easily be overcome by anti-foam agents. Although we have found the best effect with special products, we normally use the same type as mentioned above for the centrifugals. The cost of reducing foam at this point is rather low, and the savings in material by using two different types do not pay for installing duplicate systems.

SSA policies when selecting anti-foam agents

As can be understood from the above-mentioned case studies, we have, over the years, paid some attention to the proper selection of anti-foam agents and also tested quite a few. From all these experiences we have arrived at a set of policies that can be formulated in the following rules: –

(1) Anti-foams for the sugar extraction and all following processes must have a very low toxicity to man. The toxicity should be documented both by LD_{50}-values and by official approval in Germany, France or the USA. These products must not contain above 0.2% steam-distillable material.

(2) Anti-foam agents for outdoor use should also have a reasonably low toxicity to man. They should further be free of mineral oils, be biodegradable and have no negative influence on the biological treatment of waste water.

(3) The complete composition of the agent must be known to us.

(4) We need the cooperation of the vendor in order to find the best ways of using their products. Four firms, with whom we already have good relations, are given facilities to test new products in our factories. Any other manufacturer must present reliable documentation of superior performance in foreign sugar factories before we will consider tests with their products.

(5) The products must be registered by the Swedish authorities for the public safety of chemical products. This will take into account both the environmental risks and the risks to the workers.

(6) A thorough examination of the documentation will precede any factory test.

(7) Every year our chemical control department makes a comparison of the behaviour of the anti-foams used. This comparison forms the basis for the factories' selection for the next year.

(8) Continuous efforts are made to trace the routes of any process additives including anti-foam agents.

The route through the process

The methods that we have been using in tracing the routes of the anti-foams in the different process steps have been given in a report to the Amsterdam CITS meeting. The results can be presented as balances, as shown in Figure 1 and in Tables III and IV. Figure 1 shows the balance of the outdoor water system. In the particular case described, anti-foams were added at a rate of 12 ppm in the flumes and 2 ppm at the beet washer. The return water from the

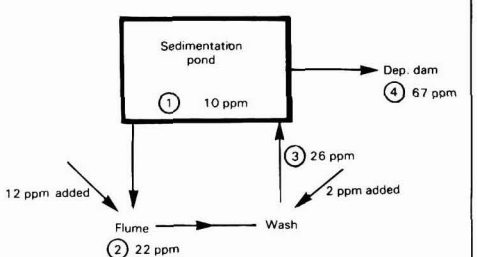


Fig. 1. Balance of Product A in outdoor water system at factory No. 1

clarifier already contained 10 ppm. The measured concentrations before and after the washer were 22 ppm and 26 ppm respectively, which is consistent with the error of analysis. Very little of the defoamer was, therefore, adsorbed by the beet.

In the extraction process, Table III, the balance could only account for 72% of the added amount, but we regard this as a consequence of chemical breakdown of the defoamer. Roughly equal proportions were found on the cossettes, in the carbonatation sludge and in the thin juice respectively. There is no reason at all to expect that the defoamer used in the extraction could not end up in the sugar house.

Table III. Balance over the extraction

Anti-foam agent: a mixture of alkoxane ethers

	mg/kg sample	mg/kg cossettes	%
Input	–	79	100
Output			
Pulp	25	17	22
Sludge	176	16	20
Thin juice	20	24	30
		57	72

We found, however, that only 10% of the amount in the thin juice could be retrieved in the thick juice. This result still puzzles us for, as stated above, we know that our anti-foams are not steam-distillable. We think that they might not be thermally stable, but we should then very much like to know what the degradation products are. It may be that they are volatile and disappear through the condenser, but that still remains to be proved

Over the sugar house, Table IV, the balance is very confusing as we have found more anti-foam agent in the molasses than that which was added. This could very well be a result of combination of improper sampling and of inferior precision in our methods of analysis. In any case it must be evident that almost all of the anti-foam agent introduced into the sugar house, either by the thick juice or as a direct addition, will end up in the molasses.

Table IV. Balance over the sugar boiling

Anti-foam agent: Alkoxane ether of lauryl alcohol

	mg/kg sample	mg/kg cossettes	%
Input –			
Thick juice	11	3	
Added	13	3.5	100
Output			
Sugar	0	0	0
Molasses	187	8.5	131

In separate experiments we have tried also to determine the amount of anti-foam agent that is left on the sugar crystals. Although the precision of those determinations is not very impressive, we are confident that the concentration does not exceed 0.4 mg/kg. The product used has an LD_{50}-value of more than 10 g/kg which, with a safety factor of 200, corresponds to 50 mg/kg body weight as the permissible dose. This would imply that a 50 kg man would have to eat 6 tonnes of sugar to get a dangerous amount of chemicals!

Economy

This paper started by stating that anti-foam agents cost quite a lot for the sugar producer. This is still true in spite of all the efforts to reduce the costs. Anti-foams are the largest cost of any process aid used. We think, however, that determined work in this field does help to reduce costs, and that lesser risks to man, and to his environment, will follow. In Table V, the costs and the amounts used in the Swedish factories are given together with the average LD_{50}-values of the products used in 1971, 1978 and 1979 respectively. When judging the amounts it must be remembered that the products used in 1971 still contained mineral oils. The load on the environment is greatly diminished by the use of easily biodegradable agents in 1978 and 1979.

Table V. Total anti-foam agents used

	1971	1978	1979
Cost, £/tonne sugar	0.15	0.57	0.52
Price index	100	462	545
Total amount, tonne	250	275	230
Average LD_{50}-value	0.50	5	10

Summary

The advent of modern anti-foam agents to replace the simpler, cheaper but less efficient agents based on minerals oils and animal fats is described, with an account of their adoption in various sections of the sugar factories in Sweden. The policy of the Swedish Sugar Corporation in selecting materials for use and for testing is discussed, as are the fate of the anti-foam agents during the process and the economics of their use. In spite of efforts to reduce it, the cost of anti-foam agents is the largest of any process aid used in the beet sugar factory.

L'emploi sûr et économique des anti-mousses en sucrerie

L'avènement des agents anti-mousses modernes, destinés à remplacer les agents meilleur marché mais moins efficaces, à base d'huiles minérales ou de graisses animales, est décrit avec un relevé de leur adoption dans diverses sections des sucreries en Suède. La politique suivie par la Société Sucrière Suédoise dans la sélection et l'essai des matières est discutée, ainsi que le comportement des agents anti-mousses en cours de fabrication et le côté économique de leur emploi. Malgré les efforts faits pour le réduire, le coût des agents anti-mousses est le plus élevé de tous les adjuvants de fabrication utilisés dans l'industrie du sucre de betterave.

Sichere und wirtschaftliche Verwendung von Anti-Schaummitteln in Rübenzuckerfabriken

Die einfachen und billigen jedoch wenig wirksamen Anti-Schaummittel auf Mineralöl- und Tierfett-Basis werden durch moderne Anti-Schaummittel ersetzt, über deren Anwendung in verschiedenen Stationen von schwedischen Zuckerfabriken berichtet wird. Die Methode der Svenska Sockerfabriks AB, nach der sie die Substanzen für den Gebrauch und die Tests auswählt, der Verbleib der Anti-Schaummittel während der Verarbeitung und die Wirtschaftlichkeit ihrer Verwendung werden diskutiert. Trotz aller Anstrengungen, die Kosten für Anti-Schaummittel zu senken, sind sie die höchsten von allen Hilfsmitteln, die bei der Rübenzuckerfabrikation verwendet werden.

Uso seguro y económico de agentes anti-espumas en ingenios de azúcar de remolacha

El advenimiento de agentes modernos contra espuma que han reemplacido los agentes más sencillos y más baratos pero menos eficientes, que estan basado en aceites minerales y grasas animales, se describe con una

cuenta de su adopción para diferentes secciones de los ingenios de azúcar de Suecia. La política de la Sociedad Azucarera Sueca en selección de materias para uso y para prueba se discute, y también el destino de los agentes anti-espumas durante el proceso y la economía de su uso.

Safe and economical use of anti-foam agents

No obstante esfuerzos por su disminución, el costo de agentes antiespumas es el más grande de todo los ayudos del proceso empleado en el ingenio de azúcar de remolacha.

Ethanol from unclarified cane molasses Part 1. Recycling of yeast using centrifugation

By S. S. DHAMIJA, D. S. DAHIYA, M. C. BARDIYA and P. TAURO
(Department of Microbiology, Haryana Agricultural University, Hissar-, India, 125004)

Introduction

The feasibility of yeast biomass recovery after molasses fermentation by natural sedimentation and its recycling has been reported[1]. This results in higher ethanol yields as some of the sugars, which would have otherwise been used to propagate the yeast, are converted into ethanol. The fermentation parameters and other conditions for this technique of yeast recycling using "unclarified cane molasses" have also been standardized and reported[2]. This technique of yeast recovery by natural sedimentation and its recycling has been tested beyond twenty fermentation cycles and found to yield 8.0 to 8.3% of ethanol consistently in 24 hr with a fermentation efficiency greater than 90%. However, by this technique of yeast biomass recycling, we could not achieve a fermentation time less than 24 hr. This was perhaps because of the fact that there is a limited settling of yeast biomass within 24 hr of the fermentation cycle. For rapid fermentation and high ethanol yields, the use of high yeast concentration for initiating the fermentation is suggested[3].

For fast fermentation of molasses, a process of yeast recycling was patented in 1936 by Boinot[4] which is based on the use of a centrifuge for the recovery of yeast biomass from wash instead of natural sedimentation. In operating the Melle-Boinot recycling process, the molasses must be clarified and is either pasteurized or sterilized before fermentation. Apart from this, yeast slurry obtained from the wash is also treated with H_2SO_4 to eliminate contamination and activated by growing separately for a few hours. The Melle-Boinot process of yeast recycling in molasses-based distilleries is therefore not so popular in many of the countries, particularly in India, owing to the expensive pretreatment steps involved. The present communication deals with studies to by-pass these pretreatment stages.

Materials and Methods

Organism and fermentation media: The details of the yeast *Saccharomyces cerevisiae*, the composition of cane molasses, inoculum and fermentation media used in the present studies were reported earlier[2,5].

Inoculum preparation and fermentation: Inoculum medium (100 cm^3) was seeded with a 24 hr-old yeast slant culture. After 12 hr of incubation at 30°C the contents of the flasks were asceptically transferred to 500 cm^3 medium of the same composition and again incubated for 12 hr. The inoculum was then added to 3000 cm^3 production medium and allowed to ferment for 24 hr. For the purpose of recycling, a yeast pellet was recovered by centrifugation of varying amounts of this fermented wash at 3500 rpm for 5 min and added to 1000 cm^3 of the fresh production medium as follows:

(i) Yeast recovered from 250 cm^3 wash (hereafter referred to as treatment 25%)
(ii) Yeast recovered from 500 cm^3 wash (hereafter referred to as treatment 50%)
(iii) Yeast recovered from 750 cm^3 wash (hereafter referred to as treatment 75%)

Culture conditions: The fermentation temperature was maintained at 30°C and the samples were withdrawn after 12, 18 and 24 hr of fermentation for analysis. The viable yeast counts were determined by plating appropriate dilutions on GYE agar plates at the start of each cycle. The experiment was continued up to six cycles.

Analytical procedures: Initial and residual sugars in the molasses medium were determined by the standard methods of the AOAC[6] and ethanol content by the

[1] Bardiya, Sharma and Tauro: *I.S.J.*, 1980, **82**, 46-47.
[2] Dahiya, Bardiya, Dhamija, Sharma & Tauro: *ibid.*, 203-206.
[3] Nagodawithana, Castellano and Steinkraus: *J. Appl. Microbiol.*, 1974, **28**, 383.
[4] U.S. Patent 2,063,223 (1936).
[5] Sharma, Dhamija, Dahiya & Bardiya: *Indian J. Microbiol.*, 1979, (in press).
[6] "Official methods of analysis", 12th Edn., (A.O.A.C., Washington DC), 1975, pp.577-581.
[7] Caputi, Ueda & Brown: *Amer. J. Enol. Vitic.*, 1968, **19**, 60.


S. S. Dhamija


D. S. Dahiya


M. C. Bardiya

potassium dichromate reduction method[7]. The fermentation efficiency was calculated as described earlier[2].

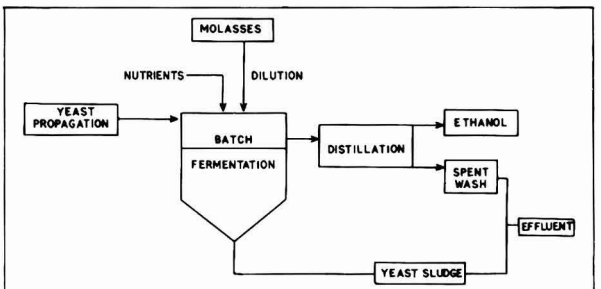


Fig. 1. Present ethanol production process in India

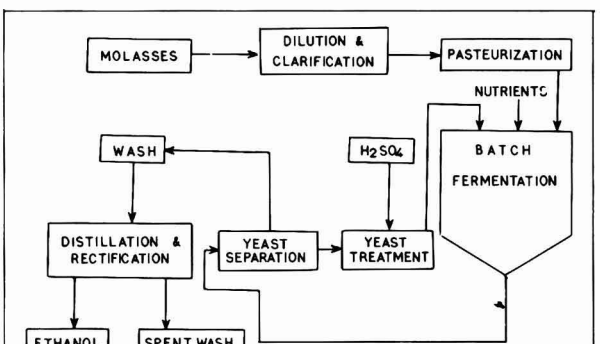


Fig. 2. Main steps in Melle-Boinot recycling process

Results and discussions

Fig. 1 illustrates the steps of the process of ethanol production from cane molasses in India. For the purpose of comparison, the main steps of the Melle-Boinot yeast recycling process have been outlined in Fig. 2. Because of these costly additional steps of pretreatment of molasses and yeast, the process is in limited use. The yeast was therefore recovered from the wash by centrifugation and recycled as such into unclarified and unpasteurized molasses production medium.

In the first cycle of fermentation, the initial viable yeast cell concentration was proportional to the volume of the wash used for the recovery of the yeast. Consequently, ethanol production at every stage of fermentation was found to follow closely the initial cell counts, i.e. highest in the treatment 75% (Table I; Fig. 3). Irrespective of the treatments, the initial yeast cell concentration of the production medium and ethanol production at all stages of fermentation (12, 18, 24 hr fermentation) increased up to the third cycle and thereafter were stabilized. This increase was also proportional to the volume of the wash used for the recovery of yeast mass. The increase in viable cell number in subsequent cycles (up to three cycles) was because of the growth of yeast.

Further, in the first cycle, fermentation could be completed in 24 hr in case of treatments 50% and 75% but not in treatment 25%, obviously leaving higher unfermented sugars in the wash (Table I; Fig. 3).

This behaviour was observed consistently in all the six cycles of fermentation. Perhaps the cell number build-up was never sufficient to complete the fermentation. However, the yeast from 50% of the wash (treatment 50%) could ferment in 24 hr in the first two cycles and in 18 hr in subsequent cycles. In treatment 75%, fermentation was over within 12 hr after the second cycle. From this study an inverse correlation between initial yeast cell number and the fermentation completion time could be established (Fig. 4). For example, at a yeast concentration of 7.0-8.0 x 10^7 per cm^3, fermentation takes 18 hr for completion while at a cell concentration of 11.5-12.5 x 10^7 per cm^3 it is over within 12 hr. These recycling studies suggest that pretreatment of molasses and yeast slurry, the essential steps of the Melle-Boinot yeast recycling process, may be avoided and the time cycle of fermentation conveniently regulated depending upon the availability of centrifugation facilities in the distillery unit. Practical difficulties prevented examination of treatment 100%, i.e. centrifugation of whole fermented wash for the recovery of yeast, but this could be practical and should be able to complete the fermentation in even less than 10 hr.

As seen from Table I the fermentation efficiency of the recycling process was very close to the theoretical limits (91-94%) and comparatively higher than the natural sedimentation technique of re-

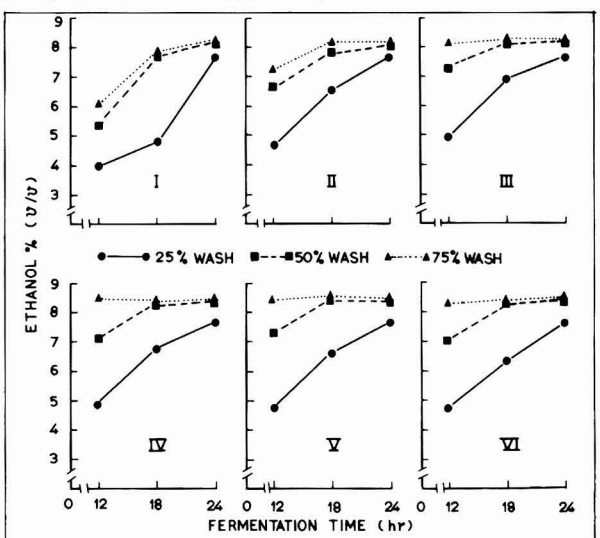


Fig. 3. Ethanol production six cycles of fermentation

Table I. The performance of yeast recycling at different cycles of fermentation

Cycle	Wash centrifuged (%)	Initial yeast count ($\times 10^7$)	Initial sugar (%)	Residual sugar (%)	Ethanol produced % (v/v)	Fermentation efficiency (%)
I	25	2.3	15.8	3.9	7.6	86.3
	50	4.6	15.8	2.2	8.0	90.9
	75	6.5	15.8	2.0	8.1	92.0
II	25	3.5	15.8	4.0	7.6	86.3
	50	7.6	15.8	2.2	8.0	90.9
	75	9.8	15.8	2.1	8.1	92.0
III	25	3.6	15.8	4.1	7.6	86.3
	50	7.7	15.8	2.1	8.1	92.0
	75	11.5	15.8	2.0	8.1	92.0
IV	25	3.2	16.1	4.4	7.6	85.3
	50	7.3	16.1	2.2	8.2	92.1
	75	12.8	16.1	2.1	8.4	94.3
V	25	3.3	16.1	4.3	7.6	85.3
	50	7.0	16.1	2.1	8.3	93.2
	75	12.3	16.1	2.1	8.4	94.3
VI	25	3.2	16.1	4.2	7.6	85.3
	50	7.9	16.1	2.1	8.4	94.3
	75	11.7	16.1	2.1	8.3	93.2

Experimental conditions: Production medium unsterilized 22.00 to 22.5°Brix molasses solution containing 0.2 kg urea and 0.02 kg phosphoric acid per 100 kg of fermentable sugars; pH 5.0; temperature of fermentation 30°C; scale 1000 cm^3.

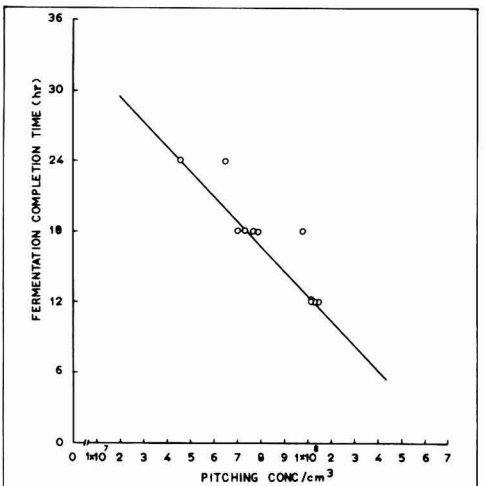


Fig. 4. Relationship between pitching concentration and fermentation time

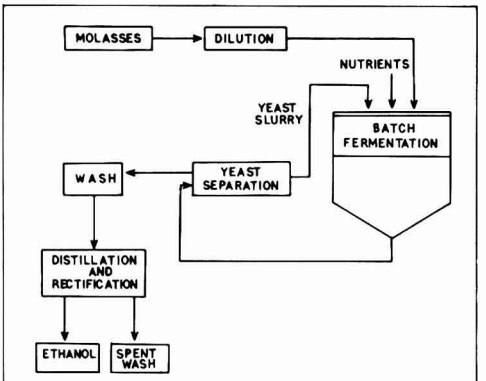


Fig. 5. Recycling of yeast in cane molasses fermentation

cycling[2], in all cycles of treatments 50 and 75%, while it was low in the case of treatment 25% which was obviously due to the incomplete fermentation (high residual sugars in the wash). Although higher productivities and fermentation efficiencies from cell recycling by vacuum fermentation using dextrose have been reported[8], this technique of recycling using centrifugation and unclarified molasses as substrate was investigated under normal conditions of distillery fermentation and turns out to be more economical than the Melle-Boinot process. Fig. 5 shows the simplified process of yeast recycling. The only additional investment in the present set-up of the distilleries is on a continuous-flow centrifuge. By this technique, the existing molasses fermentation capacity of a distillery unit can be increased significantly. Our calculations show that using unclarified molasses, the alcohol production rate could be as high as 0.7% per hour.

Summary

Studies conducted on the laboratory scale indicate that the pretreatment steps of the Melle-Boinot process of yeast recycling in molasses fermentation can be by-passed. By using unclarified molasses and without yeast activation treatment, the fermentation time could be as short as 12 hr when recycling the yeast recovered from 75% of the wash. The fermentation efficiencies were as high as 91-93% in all the six cycles tested.

Ethanol à partir de mélasses à canne non-clarifiées. 1ère Partie. Recyclage de la levure au moyens de la centrifugation

Etudes à l'échelle de laboratoire indiquent que les étages de prétraitement dans le procédé Melle-Boinot de recyclage de la levure peuvent être evités dans le cas de fermentation de mélasses. Par l'emploi de mélasses non-clarifiées et sans activation de la levure, on pouvait réduire le temps de fermentation à 12 h avec recyclage de la levure récupéré à partir de 75% de la solution de lavage. Les efficacités de fermentation étaient jusqu'à 91-93% dans les six cycles testés.

Äthanolherstellung aus ungeklärter Rohrmelasse. Teil 1. Heferückführung mittels Zentrifugierung

Untersuchungen im Labormaßstab zeigen, daß die Vorbehandlungsstufen des Melle-Boinot-Verfahrens von Heferückführung bei Melassegärung umgegangen werden können. Durch Verwendung von ungeklärter Melasse ohne Hefeaktivierung konnte die Gärungszeit bei Rückführung der aus 75% Waschlösung gewonnenen Hefe bis zu 12 h reduziert werden. Die Gärungsleistungsfähigkeiten waren bis zu 91-93% in den sechs versuchten Zyklen.

Etanol de melaza de caña no-clarificada. I. Reciclo de levadura usando centrifugación

Estudios conducido en escala de laboratorio indican que las etapas de pre-tratamiento del proceso Melle-Boinot de reciclo de levadura en fermentación de melaza pueden evitarse. Por el uso de melaza no-clarificada, y sin tratamiento para activación de la levadura, la duración de fermentación puede reducirse a 12 horas cuando se ha reciclado la levadura de 75% del mosto. La eficiencia de fermentación alcanza niveles de 91 – 93% en todos los seis ciclos examinado.

[8] Cysewski & Wilke: *Biotechnol. Bioeng.*, 1977, **19**, 1125.

SUGAR CANE AGRONOMY

Studies on weed control in sugar cane. S. S. Narwal and D. S. Malik. *Indian Sugar,* 1980, **30,** 187-191. – Herbicide trials conducted during 1974-75 are reported. Results showed that best in terms of both weed mortality and increase in cane yield over the unweeded control was pre-emergence application of Fernoxone + Gramoxone (containing Paraquat as active ingredient) at 3.0 kg + 1.5 litres per ha. Evaluation of the economics showed that this treatment gave by far the highest net income.

Determination of the water regime during ripening of a sugar cane crop in the north of the Ivory Coast. P. Langellier. *Agron. Trop.,* 1980, **35,** 232-239 *(French).* – A neutron probe and tensiometers were used to determine the water content and hydraulic pressure in soil profiles to a depth of 120 cm. The results are plotted, and application of the data to irrigation scheduling demonstrated. The simultaneous use of neutron probe and tensiometers proved to be an effective aid, with some limitations (briefly discussed). A water-type tensiometer was as reliable as a mercury type.

Available phosphorus for sugar cane (*Saccharum* spp.) in soils of the state of Rio de Janeiro. M. S. Manhães and N. A. Glória. *Brasil Açuc.,*1980, **96,** 21-30 *(Portuguese).* Although cane growing is the basis for the socio-economic structure of the north of Rio de Janeiro state, little scientific work has been done to determine the response to P fertilization in the region. In order to assess P availability of the various soils, five extractants were used, and it was established that the use of 0.5N H_2SO_4 gave a result closest to the actual P available to sugar cane.

Effect of the soil and age of the plant on the absorption of boron by sugar cane variety CB 41-76. J. Orlando, E. Zambello and H. P. Haag. *Brasil Açuc.,* 1980, **96,** 31-41 *(Portuguese).* – The same cane variety was grown on three types of soil and samples taken at 2-month intervals between the 4th and 16th months for plant cane and between the 4th and 12th months for ratoon cane; soil samples were taken at the same time. Boron analyses were made, and it was concluded that, for both plant and ratoon cane, the type of soil influenced the uptake of boron by "stalks + leaves", and its removal by stalks. At 12 months, these amounted to 149-209 $g.ha^{-1}$ and 87-145 $g.ha^{-1}$, respectively, for ratoon cane. (The plant cane data have been omitted in error.) The patterns of changes in leaf and stalk B contents with time were different for different soils.

Cost of production of sugar cane, May 1980. C. M. González T. and C. A. Gargiulo. *Publ. Misc. Estac. Exp. Agro-Indust. "Obispo Colombres"* (Argentina), 1980, (67), 13 pp *(Spanish).* – Calculations have been made on a basis of a total area of 100 ha, of which 90 ha is the crop area and the remainder roadways, etc. The cane is grown on 60 rows per ha, with a yield of 1 tonne per row. Labour costs are on the basis of legal wage tables established by the government with a 20% increment for skilled personnel such as tractor drivers, etc. Depreciation of capital equipment has been assumed to be linear over its useful life. Standard formulae and indices have been used for calculating fuel, lubrication, repair and maintenance costs, and the direct and indirect costs applicable in Tucumán are thereby obtained and tabulated.

New land development – reap the benefits of careful planning. W. A. C. Webb and P. R. Downs. *Cane Growers' Quarterly Bull.,* 1980, **44,** 36-44. – Factors that should be considered in the development of new land for cane growing are discussed, including potential soil and drainage problems, land clearance, drainage, movement of farm machinery, nutrition, irrigation, cane varietal selection, and control of weeds, pests and diseases.

Farming in the '80's – are you ready? A. I. Linedale. *Cane Growers' Quarterly Bull.,* 1980, **44,** 45-47. – The author suggests ways in which the cane grower can combat rising production costs, including adopting multi-row operations, combining various field operations, using the most efficient means of achieving a particular objective (such as in the use of herbicides and fertilizers), and adopting the most suitable farm design.

Inter-farm comparison – another management tool. L. G. W. Tilley. *Cane Growers' Quarterly Bull.,* 1980, **44,** 47-48. – A system is explained which permits a cane grower to compare performance data for his farm with those of neighbouring farms. The farms are grouped according to similarity of soil type, climate and topography, and the position of the individual farm within the group first established relative to the average, worst and best performances; by means of discussions, members of the group can provide and obtain information of value for increased productivity.

Pre-emergence herbicides prove effective for vine control. P. J. McGuire. *Cane Growers' Quarterly Bull.,* 1980, **44,** 50-51. – Diuron at 4.5 $kg.ha^{-1}$ and DPX-410 (an experimental product) at 3.0 $kg.ha^{-1}$ gave excellent control of vine weeds (convolvulus, morning glory, etc.) in cane blocks where their growth was not excessive at the time of spraying. (Where vine weeds have grown to the top of the canopy, 2,4-D or 2,4,5-T at 0.7 $litres.ha^{-1}$ should be added to the spray mix.) DPX-410 also controlled summer grass, couch grass, pigweed and nut grass, weeds that usually are a problem in late ratoon crops. At a rate of 1.2 $kg.ha^{-1}$ it still gave satisfactory vine control, but had no effect on other weeds. Neither Diuron nor DPX-410 had any phytotoxic effects on cane. However, they are more expensive than 2,4-D and 2,4,5-T.

Modified farming practices overcome drainage problems. P. A. Jones. *Cane Growers' Quarterly Bull.,* 1980, **44,** 53-55. – Despite extensive land levelling on two adjoining farms where the land is poorly drained, the heavy alluvial soil still led to germination, cultivation and harvesting problems after rain, so that the two growers decided to modify field operations. These are described with the aid of photographs. Although the practices adopted have not led to any noticeable increase in cane yield, a number of benefits have been obtained, and these are listed.

Pumps and reclamation of low lying areas. A. V. Rudd. *Cane Growers' Quarterly Bull.*, 1980, **44**, 56-57. – The construction of two home-made axial-flow pumps, designed to alleviate drainage problems in low lying areas, is described.

Fertility monitoring – a new concept. E. A. Pembroke. *Cane Growers' Quarterly Bull.*, 1980, **44**, 57-58. – The fertility monitoring program inaugurated by the Bureau of Sugar Experiment Stations involves the use of sites, measuring 50 x 50 m, in a commercial cane block; these sites are permanently identified for recording purposes, and eight such sites are allotted per mill area. When the sites were established, the soil was analysed for determination of the nutrient status, 21 analyses being performed on soil taken from three depths (0-25, 25-50 and 50-75 cm). This operation will be repeated at 10-year intervals, while at every alternate 5-year interval the 21 analyses will be made only on samples from the 0-25 cm layer. Repeated checks of the bulk density of core samples of soil down to 75 cm will be used to establish whether compaction has taken place or not. Apart from providing the site for the monitoring station, the grower records, in a special book, all activities associated with the site.

Phenoxy-type weedicides damage susceptible varieties. I. T. Freshwater. *Cane Growers' Quarterly Bull.*, 1980, **44**, 59. – Two cane varieties, Q 96 and Q 80, are susceptible to damage, at certain stages of growth, by 2,4-D and MCPA (members of the phenoxyacetic acid group of herbicides) which are effective against vine weeds. Recommendations are given on the best means of applying the herbicides without damaging the crop.

Comparative effect of some chemicals on the tillering ability of sugar cane variety Phil 56-226. P. V. Madrid and E. L. Rosario. *Sugarland*, 1980, **17**, (3), 12, 16-17. Single-bud setts were soaked for 12 hours in various solutions before planting. Greatest increase in the number of tillers resulted from soaking in 100% (v/v) coconut water, while treatment with 70 ppm Bualta and 50% coconut water gave almost as good results. Other parameters such as % germination, seedling emergence and plant height also responded positively to treatment.

Classification of Central Romana soils for management purposes. L. M. Alcantara. *Sugar J.*, 1980, **43**, (5), 17-20. Preliminary work on classification of soils in the Central Romana area of the Dominican Republic is discussed. So far, 21 soil types representing 30.5% of the area planted with Administration cane have been identified and grouped under five categories based on their similarity with regard to cane growing. The characteristics of these soils are described, their fertilizer responses indicated, and recommendations given on optimum agronomic practices and cane varieties.

Absorption and removal of zinc by sugar cane, variety CB 41-76, from three soils in the state of São Paulo. J. Orlando, E. Zambello and H. P. Haag. *Brasil Açuc.*, 1980, **96**, 83-92 *(Portuguese)*. – CB 41-76 cane was grown on three different soils in São Paulo and samples taken of cane and soil at intervals of 2 months from 4 to 16 months of age in the case of plant cane and 4-12 months for the ratoon crop. Zinc analyses showed that, in both crops, the type of soil influenced the amounts of Zn removed by leaves and stalks and the pattern of changes in the different parts of the plant. At 16 months of age, plant cane removed 688-987 g Zn per ha in stalks + leaves, and 387-635 g.ha^{-1} in stalks alone. Corresponding figures for the ratoon crop at 12 months were 435-592 g.ha^{-1} and 255-412 g.ha^{-1}, respectively.

Application of nitrogenous fertilizers to the sugar cane crop. R. L. Yadav. *Indian Sugar Crops J.*, 1980, **7**, (1), 3-5. – The functions of N, symptoms of N deficiency in cane, rate and time of application of the fertilizer and the forms in which it is available are discussed, and results of field and pot culture trials are tabulated.

Damaging effects of hailstorms on sugar cane. R. S. Kanwar and O. Singh. *Indian Sugar Crops J.*, 1980, **7**, (1), 6-7. – Studies to assess the damage caused by hailstones to a cane crop in 1977 are reported. The storm had a wind velocity of 80 km.hr^{-1} and the average weight of the hailstones was 50 g. Maximum damage, in the form of shredded leaves, occurred in 12-month cane, followed by 5- and 2-month cane. It was greatest in those varieties having broad leaves and in the upper portion of the leaf blade. Bud injury also occurred. Co 1158 cane suffered most leaf and bud damage.

Companion cropping with autumn-planted sugar cane – a critical review. IV. Intercropping of pea with autumn-planted sugar cane. K. S. Rathi and R. A. Singh. *Indian Sugar Crops J.*, 1980, **7**, (1), 16-21. **V. Intercropping of gram with autumn-planted sugar cane.** *Idem ibid.*, 22-26. – Results of trials on intercropping of pea and gram with autumn-planted cane are reported, the economics evaluated and *ad hoc* recommendations given.

Relationship between soil parameters, tissue indices and sugar cane yield. A. S. Patil and G. K. Zende. *Proc. 30th Ann. Conv. Deccan Sugar Tech. (India)*, 1980, (1), A.21-A.32. – Investigations are reported on the relationships between cane yield, soil fertility status and tissue indices. The numerous inter-relationships are indicated, and it is concluded that optimum cane yields can be achieved by maintaining an adequate supply of soil nutrients through efficient fertilization and adoption of correct soil management practices.

Residual phosphate in entisol and its effect on the sugar cane ratoon. S. M. H. Jafri. *Proc. 30th Ann. Conv. Deccan Sugar Tech. Assoc. (India)*, 1980, (1), A.45-A.50. Residual P found in alluvial soils in Uttar Pradesh was found to increase the yields of 1st, 2nd and 3rd ratoon crops by comparison with results where there was no residual P. There was a marked fall in yield between each crop where residual P was present, but little change in yield where it was absent.

A sugar cane crop in 8 months: necessity, possibilities and problems. B. Sundara. *Proc. 30th Ann. Conv. Deccan Sugar Tech. Assoc. (India)*, 1980, (1), A.149-A.154. – While a number of cane varieties have ripened in about 8 months, they have not been generally accepted in India because of their poor yields. To raise the yield, the author proposes narrow inter-row spacing, but this would create problems for many cultivation practices which have been adopted for use with conventional spacing. Radical changes in such practices are therefore needed. The subject is discussed and references made to the literature.

SUGAR CANE MECHANIZATION

A simple, wide-furrow covering tool. C. Richard. *Sugar Bull.,* 1980, **58,** (20), 10-13. – An illustrated description is given of a new device for the covering of cane planted in a wide furrow which avoids pushing the setts together to form a single row. A heavy, free-floating press wheel is followed by two rear disc gangs, and the whole machine is hauled by a standard plantation tractor. The press wheel does not damage dormant buds, and the cane does not move during covering.

A no-chain cane delivery system. D. H. Carter-Brown. *Proc. 54th Ann. Congr. S. African Sugar Tech. Assoc.,* 1980, 22-25. – A cane harvesting system which eliminates the use of chain slings has been developed on Illovo's estate. A semi-mechanized "split harvesting system" has been adopted; conventional trailers are used for infield haulage and unload loose cane into windrows on the loading banks. Grab-loaders then transload the cane from the windrow into Hilo cane lorries for transportation to the mill. Reductions in staff on the loading banks have been achieved, and the running costs of the grab-loaders are found to be similar to those of the conventional Mobamech cranes which are operated by Illovo on the loading banks for growers' cane.

Experiences with a prototype green cane whole-stick harvester. J. R. Pilcher and M. Boast. *Proc. 54th Ann. Congr. S. African Sugar Tech. Assoc.,* 1980, 189-194. In 1976/77 a McConnel whole-stick harvesting system for green cane was tested. It was in two parts, the first stage pushing over the cane to form a "sausage" which was then drawn through a second stage, where tops and trash were removed and the stalks deposited in bundles for loading. The Stage II machine did not work satisfactorily except on flat ground and was under-powered. Areas in South Africa where green cane harvesting would be of advantage often have slopes up to 30%, and it was decided at the South African Sugar Association Experiment Station to attempt to construct a machine suitable for such conditions which was based on the same principle of a single-pass cleaning and topping machine. An account is given of the initial tests using the discarded McConnel unit, trials with the Sasaby unit designed and built on a basis of these tests, of the modifications made to the design and subsequent trials. The machine which has resulted is not suitable for commercial operation and works more as a mobile test rig. However, the principle of single-pass operation is apparently satisfactory, and results have been sufficiently encouraging to warrant reconstruction and further development.

HC & S Company mechanical seed dropping. W. Bisgard. *Rpts. Hawaiian Sugar Tech.,* 1979, 180-181. – In order to overcome planting rate limitations and cost of manual dropping of cane in the planters used by Hawaiian Commercial & Sugar Co., attempts were made to build fully mechanical planters. The third and only successful machine used a simple, slat-type conveyor to pull seed cane from the pile and lift it from the main bin to drop into the plough box. This worked well, and a second machine was converted in the same way, although the rubber slats were replaced with metal ones. The need to supply missed cane from the furrow has been found to be associated with the seed cane quality rather than the rate of planting, and tests are being run at up to 4 bins per acre against a maximum of 2.25 with manual dropping.

Energy conservation in cane tillage. L. G. Reeser. *Rpts. Hawaiian Sugar Tech.,* 1979, 184-188. – With the object of energy conservation, a survey is made of the characteristics of wheel and track-type tractors, and the latter shown to be more economical.

Goondi growers design inter-row cane trasher. P. K. Makepeace. *Cane Growers' Quarterly Bull.,* 1980, **44,** 20-21. – A trash removing device is illustrated, together with an example of its work. It embodies three 1500-rpm fans mounted one above the other and operating horizontally; they blow the trash off the cane from each side of the cane row as the trasher is drawn by a tractor along the row and back. The device is driven from the tractor p.t.o. and uses some 5-6 hp per fan with a similar loss in transmission.

Problems to be solved as cane transport units grow. Anon. *Australian Canegrower,* 1980, **3,** (10), 37-39, 46. A short survey is given of the types of cane transport system used in Queensland. With the development of heavy, high-capacity units there has been a considerable rise in capital costs as well as in the damage to soil structure and ratoon crops during wet weather harvesting; the tendency for transport units to increase in size is considered likely to continue. Regardless of size, there would be advantages of having a standard mill bin throughout the industry, since the diversity in bin sizes creates problems in the manufacture of side tippers, increasing their costs. Higher flotation tyres and weight transfer systems have given a partial solution to the problem of cane haulage from wet fields without excessive damage to the crop. While most cane harvesters have tyre ground pressures below 200 kPa, most tractor and truck haul-out units commonly have tyre pressures of about 300 kPa.

Transport systems as a means of profit. H. Poole. *Australian Canegrower,* 1980, **3,** (10), 41, 43-45. Factors of significance in the development and use of a cane transport system are discussed, including the ratio of weight of the system to the payload, soil compaction, the horsepower:payload ratio, mechanical simplicity, the degree of utilization of the system, and aspects of tyre use.

Tramway bin design needs an overhaul. Anon. *Australian Canegrower,* 1980, **3,** (10), 57. – According to the Sugar Research Institute, new designs are needed for cane tramway rolling stock and cane bins in the Australian sugar industry. Cane bin maintenance is a major cost factor in the operation of a sugar factory, and high maintenance requirements result from poor design standards and poor quality control in the manufacture and assembly of components. Damage is also caused, in some cases, by in-field practices and the general nature of the roll-on, roll-off system of loading and handling of the cane bin.

When time is of the essence and the essence is sugar

Raw and white crystal–Alex Stewart's experts can make life a whole lot sweeter.

Whether you are buying or selling we protect you against weight shortage–and operate in many of the world's major sugar ports.

We control at pre-shipment and discharge and can make document and cargo checks.

In a fluctuating money market Alex Stewart's speed and accuracy can save you a lot of money.

'If you are suffering weight losses, call us today.'

ASA

Alex Stewart (Assayers) Ltd

Caddick Road, Knowsley Industrial Estate, Merseyside L34 9ER, England.
Tel: 051-548 7777 Telex: 627759
Alex Stewart Chile y Cia Ltda, Merced 380 Oficina 71, SANTIAGO, Chile.
Tel: 396 044 Telex: 352 0251

Load Ports/Destination Ports: Belgium, Brazil, Colombia, Eastern Europe, Equador, Far East, France, Germany, Holland, Peru, Portugal, Scandinavian Countries & United States of America.

Our centrifuga
suit eve

Batch centrifugals

Our programme comprises centrifugals for 650 to 1,550 kg per charge. For these duties our „Standard" and „Variant" types are available.

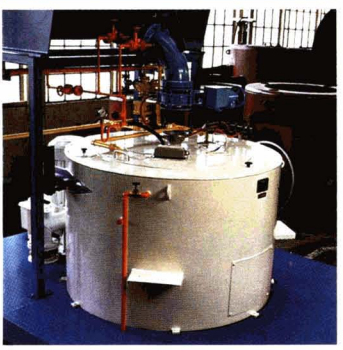
Special features

* Centering of spindle and basket during the discharging process ensures optimum safety and minimum screen wear at a high discharging speed
* Short charging and discharging times permit large numbers of charges to be handled
* Large range of baskets – made of fine-grained or stainless steel, some provided with reinforcing hoops and with perforations subject to the product concerned, screens with large open screen areas and ample clearance between cover screen and basket wall – suits every application and gives a high sugar quality
* Easily accessible valve battery and integrated control panel to adjust the speeds and working cycles
* Bottom hood closing the basket during the charging and centrifuging process prevents the discharged sugar from being contaminated

Centrifugals from BMA's large range operate in almost every sugar-producing country of the world. This is the best reference a manufacturer could furnish. At the same time a consequence of our carefully devised programme covering every application in the beet and cane sugar industry.

For charges of 650 kg our well-approved P 650 centrifugal is available in addition.

equirement.



Continuous centrifugals

For the beet and cane sugar industry our programme for centrifuging raw-sugar affination massecuites, middle-product and after-product massecuites comprises filter-type, melter-type and mixer-type centrifugals. Subject to the throughput required, the K 850 S, K 1100 and K 1500 machines are employed.

When equipped with the appropriate components, these are available as melter-type or mixer-type centrifugals, as well.

Moreover, all these centrifugals can be provided with an automatic feed control system and (for the K 1100 and K 1500) with a syrup separating device.

Special features

* Well-approved massecuite preparing device allowing easy adaptation to the product to be handled
* Central massecuite feeding device with pre-accelerator ensuring gentle treatment of the crystals and uniform distribution
* Corrosion-resisting quality of the solid-bowl basket and of all those parts coming into contact with the massecuite
* Smooth operation by a special suspension of the rotating parts
* High massecuite throughput along with excellent technological results

More than 100 years of experience in the manufacture of continuous and batch centrifugals, the high reliability of our machines, and a good price to performance proportion constitute a strong foundation for a good partnership.

BMA

Braunschweigische Maschinenbauanstalt AG

P.O. Box 3225 D-3300 Braunschweig
Federal Republic of Germany
Phone (05311 804-1 Telex 952456 abemad

BMA world-wide at home

CANE PESTS AND DISEASES

Providing resistant varieties to beat Fiji disease. C. L. Toohey. *Cane Growers' Quarterly Bull.*, 1980, **44**, 62-64. — The accelerated plant breeding program established as a means of countering Fiji disease in the Bundaberg area is described. Four seedlings resulting from the work have been approved as commercial varieties, viz. Q 108, Q 109, Q 110 and Q 111. Field results have confirmed earlier indications of their resistance to the disease, but their performances can only be confirmed by harvesting large areas over the next 2-3 years. In the meantime, other seedlings have shown resistance and are undergoing advanced trials.

Control of sugar cane smut with pyracarbolid fungicides. C. S. Atienza and L. G. Reyes. *Sugarland*, 1980, **17**, (3), 8, 22. — In an incomplete article, the authors report the results of trials on control of cane smut (caused by *Ustilago scitaminea)* by four fungicides. Lowest infection (4.29%) occurred after 20 minutes' dipping in a solution of HOE 6052 WP (5 g/10 litres), while 10 and 30 minutes' dipping gave lower infection than dipping in solutions of HOE 17411, HOE 13764 and HOE 27591; 63.46% infection occurred in the untreated controls.

Occurrence of *Acigona steniellus* Hampson in Maharashtra. A. S. Patil, D. G. Hapase, S. H. Gajare and P. R. Moholkar. *Maharashtra Sugar*, 1980, **5**, (12), 9. — Brief mention is made of the identification, in 1976, of the title pest (also known as the Gurdaspur borer) on cane in Maharashtra; this was the first record of the borer in the state, although it is common in other parts of India.

The effects of smut on sugar cane yields in Jamaica. R. A. Burgess. *Proc. 1st Inter-American Sugar Cane Seminar*, 1980, 4-6. — When smut was first identified in Jamaica in November 1976, varieties susceptible to the disease occupied 42% of the island's total cane area; HJ 5741 was the dominant variety, despite reductions in planting as recommended to growers. While elimination of susceptible varieties was regarded as the only method of smut control, the dominance of HJ 5741 combined with a slow replanting rate (about 15% annually) necessitated attempting to prolong the useful life of fields of HJ 5741 cane by various measures, chiefly roguing, which allowed clear identification of the worst affected fields, although it is doubted whether it reduced the inoculum levels; roguing also relieved healthy tillers of competition from smut-infected shoots. Yields of smut-infected cane have so far shown little evidence of marked falls relative to other varieties not susceptible to smut.

Sugar cane smut, *Ustilago scitaminea*, in Central America. A. Cawich and N. Rancharan. *Proc. 1st Inter-American Sugar Cane Seminar*, 1980, 7-11. — Smut was observed for the first time in Central America (in Belize) in July 1978 and has since been found in other Central American countries. Results of surveys conducted since 1978 to determine the distribution of the disease, level of infection and its effect on cane yield are discussed. The disease reached epidemic proportions in the most susceptible varieties, BJ 5721 and HJ 5741, with whip counts ranging from 63 to 5000 per acre (expected to exceed 10,000 per acre in 1981). Other susceptible varieties showed low infection levels. Yields were expected to fall slightly in 1981 but dramatically in 1982 when infection levels greater than 50% were expected. Inoculation tests have shown that several cane varieties have a smut reaction similar to that of BJ 5721 and HJ 5741 and should not be planted.

The current status of sugar cane smut in Florida. D. G. Holder. *Proc. 1st Inter-American Sugar Cane Seminar*, 1980, 12-15. — Of 895 cane varieties screened for reaction to smut, some 38% were found to be susceptible, the level of infection generally increasing between plant and ratoon crops. The reactions of 24 important commercial varieties grown in Florida are tabulated. Because of inadequate controls, it was not possible to assess yield losses caused by the disease. The screening of such a large number of varieties has benefited the selection programs at the U.S. Sugar Corporation (the modified form of which is outlined) and the U.S. Dept. of Agriculture.

Do races exist in pathogens of sugar cane? A. M. Whittle. *Proc. 1st Inter-American Sugar Cane Seminar*, 1980, 16-19. — The author discusses the genetic nature of plant resistance to disease and then examines evidence, as published in the literature, of the existence of strains of pathogens, particularly the causal agent of smut. He considers that there is no conclusive evidence of vertical resistance in cane (where there is a precise gene-for-gene relationship between host and pathogen) as implied from differential interaction of *Ustilago scitaminea* with host genotypes in various countries. Erroneous conclusions resulting from the assumption of the existence of different races of smut are indicated, and other pathogens for which different races have been suggested are listed.

Sugar cane smut in Argentina. N. V. de Ramallo. *Proc. 1st Inter-American Sugar Cane Seminar*, 1980, 20-23. The history of smut occurrence in Argentina since mid-1941 is outlined, and details are given of: alternative hosts; symptoms; causal agent *(Ustilago scitaminea);* spore germination, dispersion and viability; spore size differences; conditions for infection of cane; losses caused by the disease; cane resistance and screening; and methods of smut control.

Smut, *Ustilago scitaminea* Syd., of sugar cane in Mexico. S. Osada K. *Proc. 1st Inter-American Sugar Cane Seminar*, 1980, 24-27. — Smut was first discovered in Mexico in January 1980. The situation as at October 1980 is outlined, and details are given of a control program based on field inspection, evaluation of the infection and destruction of diseased stools. Resistant and susceptible cane varieties are indicated, and a census of varieties is given for each of two important areas affected. Symptoms and spread of the disease are described.

Situation of smut *(Ustilago scitaminea* Syd.) disease of sugar cane in El Salvador. L. E. Palomo. *Proc. 1st Inter-American Sugar Cane Seminar*, 1980, 28. — The smut situation in El Salvador, where the disease was first discovered in March 1980, is outlined and information

given on the cane varieties affected, of which L 60-14 was the chief one (occupying 30% of the cane area in the south-western region where the first outbreak occurred).

Reaction to smut *(Ustilago scitaminea)* disease of sugar cane varieties in Venezuela. A. Ordosgoitti. *Proc. 1st Inter-American Sugar Cane Seminar,* 1980, 29-32. Details are given of screening tests carried out immediately after the discovery of smut in Venezuela in August 1978 and in March 1980. Preliminary results are given for 7-month-old plant cane in the later tests; it is emphasized that those varieties classified as moderately resistant could exhibit susceptibility in older plant cane and ratoons.

The control of microbial diseases of sugar cane. B. Sallman. *Proc. 1st Inter-American Sugar Cane Seminar,* 1980, 37-39. – Six means of controlling cane diseases are listed, and two of them discussed. Hot water treatment of setts at 50°C for 2-3 hours or hot air treatment (in an oven) at 54-59°C for 8 hours reduces the incidence of ratoon stunting disease and a few other diseases; dipping the setts in disinfectants usually binds the latter to the outer surfaces without killing all of the pathogens and does not affect organisms inside the plant tissues, while many disinfectants are toxic to plant tissue at concentrations effective against the pathogens. The possibility of treatment with antibiotics is examined. Testing for and selecting varieties resistant to a particular disease are very time-consuming and expensive; moreover, protection is not necessarily provided against other diseases. For a more systematic approach to the problem, the author recommends development of tissue cultures derived from meristem tissue in both resistant and susceptible canes. The information on disease resistance obtained would be particularly valuable with regard to viral diseases, for which no practical control has yet been found. The role of genetic engineering in future breeding for disease resistance is discussed.

Sugar cane disease in Florida. J. R. Orsenigo. *Proc. 1st Inter-American Sugar Cane Seminar,* 1980, 40, 42-44. Diseases that have occurred most commonly in Florida cane fields are listed and briefly discussed. Mention is made of the relative importance of each and of the role of breeding for resistance.

Rust in Jamaica: characteristics of the outbreak and measures for its control. R. A. Burgess. *Proc. 1st Inter-American Sugar Cane Seminar,* 1980, 48-50. – Rust, caused by *Puccinia melanocephala,* was first detected in Jamaica in September 1978 and spread rapidly across the island; B 4362 was the variety most seriously affected. Aspects of the outbreak are discussed, including the effects of environmental factors, smut infection, cane age, climate and soil on the disease incidence, yield reductions caused by rust (of the order of 10-15%) and control of the disease. Tables are given showing the rust resistance ratings of varieties.

Sugar cane rust in Florida. J. L. Dean. *Proc. 1st Inter-American Sugar Cane Seminar,* 1980, 51-53. – The outbreak of rust in the Western Hemisphere is briefly discussed and the importance of cane breeding for resistance to the disease indicated. A major problem is the selection of a suitable standard with which to compare varieties. Difficulty is also created by the fact that a number of varieties are susceptible in their early growth stages but thereafter acquire some resistance – the relationship between cane age and level of infection differs between varieties. Environment has also been found to affect varietal resistance. The question of fungal races is briefly mentioned.

Sugar cane rust: taxonomy, epidemiology, chemical control and relative resistance of sugar cane varieties in Puerto Rico. L. J. Liu. *Proc. 1st Inter-American Sugar Cane Seminar,* 1980, 54-58. – The aspects of cane rust given in the title are discussed in relation to work being conducted in Puerto Rico. Details are given of screening trials and of the grading system used in the current breeding program. While a system of 1-5 grades is more practical than the 1-9 system described by Stakman & Harrar for cereal rust studies[1], the latter is more accurate for pathological or genetic studies and is used for these in Puerto Rico. A table is reproduced showing reactions of a large number of varieties to rust.

Sugar cane rust: infection and host response. L. H. Purdy. *Proc. 1st Inter-American Sugar Cane Seminar,* 1980, 59. The mechanism of infection of cane leaves by uredospores of *Puccinia melanocephala* is described on the basis of observations on inoculated plants. Wide differences between the reactions of different cane varieties to rust are mentioned; the need for a uniform system of recording host response as a means of comparing results obtained at different locations is stressed.

A system for recording data on the sugar cane rust/host interactions. L. H. Purdy and J. L. Dean. *Proc. 1st Inter-American Sugar Cane Seminar,* 1980, 60-64. – A system is suggested that is based on ones developed for cereal rusts. Severity is recorded as the percentage of the distal one-third of the first dewlap leaf affected by rust, while the response of the cane to the disease, i.e. the symptoms observed on the first dewlap leaf, is rated from 0 to 9. Since both severity of infection and response may change with plant maturation, the stage of cane growth must also be recorded; advice is given on the most suitable means of doing this.

Cane tonnage losses in B 4362 due to rust disease in two areas with different climates. F. Bernard. *Proc. 1st Inter-American Sugar Cane Seminar,* 1980, 65-67. – Observations from three consecutive years are reported, which showed that in one area of the Dominican Republic rust caused a significant drop in cane yield, whereas in another area yields were not noticeably affected. Since the same variety is grown in both areas, the difference in effect of the disease is attributed to a difference in rainfall; it is concluded that high rainfalls favour germination of the fungal spores.

Present situation of rust disease of sugar cane in member countries of GEPLACEA. E. A. Esquivel. *Proc. 1st Inter-American Sugar Cane Seminar,* 1980, 68-75. – It is shown that between July 1978, when rust was first found in Dominican Republic cane, and April 1980, eighteen countries in the Western Hemisphere were affected by the disease. The varieties infected are indicated, as well as the scale used to evaluate cane response, the responses of varieties to both rust and smut, and those varieties which should be withdrawn from use. The question of economic damage to the cane crop,

[1] "Principles of plant pathology" (Ronald Press, New York), 1957, pp. 135-136.

factors favouring the disease, and the effect of crop age on incidence are discussed.

Rust, *Puccinia kuehnii;* effects and attempts to control it in Panama. L. F. Narváez. *Proc. 1st Inter-American Sugar Cane Seminar,* 1980, 76-81. – Rust was discovered in Panama in November 1978 and has particularly affected B 4362 cane, the most widely grown variety. Substantial losses in yield have occurred, and the only means of control is replacement of B 4362 with tolerant or resistant varieties. Such varieties are listed, and meteorological data are given for the Santa Rosa factory area, as well as numbers and types of lesions found on infected leaf blades.

Reaction of sugar cane varieties to rust in the central region of Venezuela. A. Ordosgoitti. *Proc. 1st Inter-American Sugar Cane Seminar,* 1980, 82-85. – The reactions of cane varieties to rust, as established in screening tests started in Venezuela in 1979, are tabulated under the five classifications ranging from very resistant to very susceptible. The data show that by far the largest group is that of very resistant varieties. Climatic conditions at the experiment station where the tests are carried out are also indicated.

The aggressive virulence of red stripe disease of sugar cane in Central America and Mexico. A. L. Fors. *Proc. 1st Inter-American Sugar Cane Seminar,* 1980, 89-95. Studies have shown that red stripe (caused by *Pseudomonas rubrilineans),* to which B 4362 cane is susceptible, is a serious disease in the title regions and that the pathogen is becoming more virulent over the years. It may affect varieties that are supposedly resistant when they are grown in areas in which susceptible hosts are planted. Synergism of red stripe and rust may cause greater damage to susceptible varieties than the two diseases acting individually. Red stripe affects cane sugar content when there is an abundance of rotted tops and at the mid-growing stage, but does not appear to affect yields markedly. The symptoms do not follow a definite pattern, and when the infection level is very high certain symptoms may appear which are not characteristic of the disease. A list is given of symptoms found by the author. It is stressed that the disease is a vascular-type infection within the leaf, so that transmission is via diseased leaves but not normally via cane knives or seed.

Current status of sugar cane mosaic virus research in Puerto Rico. L. J. Liu. *Proc. 1st Inter-American Sugar Cane Seminar,* 1980, 96-98. – Electron microscope studies of the mosaic virus found in cane leaves are described. They revealed the presence of strains A and B, which constitute two of the three strains (D is the third) prevalent in Puerto Rico (in contrast to 13 strains found in the USA). Strain A was found to have little effect on growth of CP 31-294 cane, whereas strains B and D caused severe stunting. However, differences in the effects of the strains occurred with cane variety. In inoculation trials, a number of named varieties were infected to a degree which averaged 10-19%, while none of them exhibited symptoms of natural infection in the field.

Leaf scald. A. M. Whittle. *Proc. 1st Inter-American Sugar Cane Seminar,* 1980, 99-106. – Aspects of leaf scald discussed include: descriptions of the "chronic" and "acute" phases, in which symptoms are produced that are sufficiently different that at one time they were thought to be caused by different pathogens; distribution in the Western Hemisphere; description of pathogen *(Xanthomonas albilineans);* host range; means of transmission; economic importance; and possible control measures. The author states that much more needs to be known about the disease, particularly in view of the considerable losses resulting from the acute phase, which may cause death of stools and hence necessitate replanting with uninfected cane. The chronic phase reduces cane weight and Brix but does not significantly decrease the number of shoots.

The ratoon stunting disease of sugar cane and its control by use of an aerated steam treatment. R. J. Steib. *Proc. 1st Inter-American Sugar Cane Seminar,* 1980, 107-108, 112-114. – Detection of RSD in the cane field is briefly discussed, as are the losses caused by the disease and control measures. While hot water and hot air treatment have been found to reduce germination, treatment with aerated steam for 4 hours at 54°C has proved effective in completely eliminating RSD while not reducing germination.

Ratoon stunting disease of sugar cane: the causal bacterium. K. E. Damann. *Proc. 1st Inter-American Sugar Cane Seminar,* 1980, 109-111. – Results of research on RSD and its causal agent are briefly reported, covering symptoms of the disease, isolation of the bacteria from cane, description of the bacterium, sites occupied by the pathogen in the host, the effect of the disease on cane-water relationships (whereby the cane's ability to take up and transpire water is reduced), and growth of the bacterium in susceptible and tolerant cane varieties.

Moist hot air therapy of sugar cane control of sett-borne infections of GSD, smut and red rot. K. Singh, S. R. Misra, U. S. Shukla and R. P. Singh. *Sugar J.,* 1980, **43,** (5), 26-28. – Moist hot air treatment for 4 hours at 52°C or 2 hours at 54°C and 99% R.H. gave complete control of grassy shoot disease in seed cane without impairing germination, which in most cases was better than in the untreated controls. Treatment for 2 hours at 54°C eliminated smut but also prevented germination of planted buds; the same treatment reduced red rot incidence by 68% and 93% (in BO 14 and BO 17 cane, respectively), but also halved % germination of BO 14, although it substantially increased that of BO 17 cane.

The efficiency of *Apanteles flavipes* Cam is greater than that of native biological controllers of *Diatraea* spp. in Bahia. H. D. Souza. *Brasil Açuc.,* 1980, **96,** 101-108 *(Portuguese).* – The results of four years' study showed that, in test areas of Bahia, the intensity of infestation with *D. saccharalis* fell from 7.28% in 1975 (when the *A. flavipes* parasite was introduced from India) to 3.52% in 1976, 2.24% in 1977 and 2.10% in 1978. The borer is also parasitized by native parasites *Metagonistylum minense* and *Ipobracon* spp., but by 1977 the proportion of borers parasitized by *A. flavipes* had reached 56.27% of the total and 52.23% in 1978.

Leaf scald – another pathogenic problem for sugar cane cultivation in Uttar Pradesh. S. C. Gupta. *Indian Sugar Crops J.,* 1980, **7,** (1), 8-9. – Symptoms of leaf scald (caused by *Xanthomonas albilineans)* are described and results of field surveys conducted during 1977-78 in U.P. are mentioned. The chief variety affected was BO 70.

CANE BREEDING AND VARIETIES

Comparative performance of TS-1 and Co 419 in north Karnataka. H. K. S. Rao, R. S. Sachan and M. Singh. *Proc. 43rd Ann. Conv. Sugar Tech. Assoc. India,* 1979, Ag.11-Ag.14. — Further results are given of field trials on the mutant, TS-1, and its comparison with Co 419, the parent cane. (See also *I.S.J.,* 1981, **83,** 145.)

Maturity of six sugar cane varieties in Florida. J. D. Miller and N. I. James. *Proc. Amer. Soc. Sugar Cane Tech.,* 1977, 107-111. — Ten stalk samples of each of six varieties were collected and milled at intervals of two weeks from August 26 to May 17. Two early maturing varieties, CI 61-205 and CP 56-63, reached their maximum yield per ha about November 1, but did not achieve the maximum kg of sugar per tonne of cane or per ha until end-December. The two mid-season varieties, CP 63-588 and CP 56-59, reached their maximum plant yields in mid-October and their maximum sugar yields on January 27 and February 24, respectively; for the two late-maturing varieties, CP 57-603 and CI 41-223, the maximum plant yield was achieved in mid-December and mid-January, respectively, while CI 41-223 reached its maximum sugar per tonne and per ha in mid-April and mid-February, respectively. CP 57-603 achieved the corresponding maxima in mid-February and early May.

The effect of low temperature on flowering of sugar cane in Louisiana in 1976. E. D. Paliatseas. *Proc. Amer. Soc. Sugar Cane Tech.,* 1977, 117. — The flowering of cane was greatly affected by temperatures in the low 40's (°F) that prevailed in October 1976. By controlled photoperiodic treatments, it had been possible to induce all stages of flowering in September and October, but flower elongation and the last leaf stage were affected by the low temperatures, and the flowering stalks of 25 varieties died at either of these stages. However, the flowering cane stalks of another 10 varieties were unaffected at the initiation or vegetative stages. Flowering was depressed in cane stalks moved into the greenhouse on December 15, whereas it was promoted in those stalks transferred to the greenhouse on January 15. However, these differences in flowering could have been due to other factors such as light intensity or quality.

Sugar cane variety testing in Texas. S. A. Reeves. *Proc. Amer. Soc. Sugar Cane Tech.,* 1977, 118. — The six-stage variety testing program established at the Texas Agricultural Experiment Station is outlined.

Maturity studies of sugar cane varieties in Florida. E. R. Rice. *Proc. Amer. Soc. Sugar Cane Tech.,* 1977, 119-121. — The need in Florida is for varieties of high sugar content throughout the harvest season, which usually extends from late October to early April. A 3-year study of maturation patterns of seven varieties, including the three most recently released, revealed important differences in the sugar contents on the various sampling dates. All varieties averaged less sugar per ton of cane in the 2nd ratoon crop than in plant and 1st ratoon cane because of severe frosts occurring in the middle of the harvest season. Results of the experiments are tabulated.

Screening for fibre content in the Louisiana State University breeding program. C. A. Richard. *Proc. Amer. Soc. Sugar Cane Tech.,* 1977, 125. — The procedure used is the press method of cane analysis as used in Hawaii and elsewhere. Analyses of variance in a three-replication test showed significant differences in fibre content among nine commercial varieties, and indicated that several out of 26 experimental varieties had an unacceptably high fibre content. The association between fibre % in different years for the 35 varieties was very marked, as were associations between individual replications of any one year and the average fibre % of two years. The results showed that selection for fibre content was relatively easy and accurate, and that screening for unacceptable fibre could be accomplished using only one replication at an early stage.

Comparative study of 11 varieties of sugar cane. F. del Toro M., A. Dávila I. and J. A. González. *Centro Azúcar,* 1978, **5,** (3), 7-33 *(Spanish).* — Trials were conducted with 11 cane varieties using a normal and a long-cycle plant crop, each followed by a first ratoon crop. The results were analysed and four of the varieties (My 5353, My 5723, My 54121 and My 53172) recommended for the north coast of Villa Clara Province.

Comparative study of 18 sugar cane varieties. A. Chaviano H., A. Rodríguez V., N. Gallardo R. and F. del Toro M. *Centro Azúcar,* 1979, **6,** (1), 1-14 *(Spanish).* — Details are given of trials over six years, including three plant crops of 13, 16 and 22 months and the first ratoons of each. The results were analysed and the varieties Ja 60-5, My 5354 and My 5619 identified as superior.

Anther culture in sugar cane. I. Structure of the anther and its pollen grain developmental stages. M. C. Liu, W. H. Chen and L. S. Yang. *Taiwan Sugar,* 1980, **27,** 86-91. — The structure of the young spikelet of sugar cane was studied histologically. To ensure the success of anther culture, pollens at different developmental periods between archesporial and two-nuclei stages were individually screened out and cultured separately on a modified Murashige & Skoog medium with combinations of various vitamins and plant growth regulators. No calli or embryoids were produced from the pollens at any developmental stage owing to the presence of quinone, an oxidation product of phenolic compounds existing in the anther. Curtailing the oxidation of these phenolic compounds is critical to the success of sugar cane anther culture.

Research achievements in sugar cane breeding. Anon. *Taiwan Sugar,* 1980, **27,** 100-102, 105-106. — An excerpt from the Annual Report of the Taiwan Sugar Research Institute for 1978/79 lists the commercial varieties grown in that season, and notes the number of crosses made as well as the progress of selection from the seedlings of 1978 and previous years. Varieties released from June 1979 have a new system of naming, the first being ROC 1. Studies are reported on the origins of callus formation from cultured sugar cane anthers, and an account is given of international cooperation in breeding experiments with Kilang Gula Felda Perlis Sdn. Bhd. of Malaysia and in the exchange of varieties with Japan, USA, Argentina and Réunion.

Cane breeding in the West Indies. *Ann. Rpts. W. Indies Central Sugar Cane Breeding Sta. and Barbados Sugar Cane Variety Testing Sta.,* 1972/73, 63 pp. – This report describes the work of the two Stations during the period 1972/73 under classifications entitled: base broadening, commercial seedling program, Barbados variety trials, research on flowering, development of parents and progenies from four crosses in 6-ft row plots, and mutation studies. A list of varieties exported to other territories is included, as is a list of seedlings in nurseries from 1972 crosses as at September 1973.

Promising varieties for Hawaii's sugar industry. T. L. Tew. *Rpts. Hawaiian Sugar Tech.,* 1979, 107-109. The cane breeding program in Hawaii has been expanded in recent years in order to counter the threat of smut disease by producing resistant varieties. A review is presented of the varieties grown and under test in the various islands.

BSES variety work expands in the Herbert River district. H. L. Boyle. *Cane Growers' Quarterly Bull.,* 1980, **44,** 18-19. – A breeding substation has been established in the Hawkins Creek area of the Herbert River district, and a testing program instituted to select varieties which will produce good ratoons under harsh conditions. From the results achieved in 1979 and 1980, it is thought possible that varieties suitable for the area will be developed by 1983.

Advances in the experimental work on sugar cane varieties in Peru. C. Lapoint T. *Bol. Técn. Divn. Técn. Inst. Central Invest. Azuc.* (Peru), 1977, 6, 93-109 *(Spanish).* – An account is given of trials with 36 varieties in Peru, in which H 50-2036, H 57-5174, H 51-8194, H 54-2508, H 50-7209, H 49-104 and H 52-4610 proved superior to the traditional varieties H 32-8560, H 37-1933 and PCG 12-745.

Sugar cane variety outfield experiments in Louisiana 1978. K. P. Bischoff, W. R. Jackson, C. A. Richard and D. D. Garrison. *Sugar Bull.,* 1980, **58,** (22), 8-12. Results are given of 10 plant cane, 13 first ratoon and 9 second ratoon trials conducted at 13 locations representative of Louisiana cane area soil types and climatic conditions. In general, the highest sugar yield per acre on both light and heavy soils was given by CP 65-357, the leading commercial variety grown in Louisiana and used as the standard in the trials. Of the unreleased varieties, CP 72-355 and CP 72-370 gave the highest sugar yields per acre in plant and 1st ratoon trials; in the 2nd ratoon trials, CP 70-330 and CP 73-321 were comparable to CP 65-357 in terms of sugar yield.

Sugar cane variety recommendations for Louisiana for 1980. Anon. *Sugar Bull.,* 1980, **58,** (21), 8, 10-12. The recommendations given are based primarily on outfield tests, results of which are discussed. Characteristics, advantages and disadvantages of the more important commercial varieties are listed, and a variety census for all areas of Louisiana is given, clearly showing the predominance of CP 65-357 (grown on 71% of the total area compared with only 7% for the next highest in the table).

Release of two varieties. Anon. *S. African Sugar J.,* 1980, **64,** 447-448. – The two cane varieties described are N 13 and N 14. The former has outyielded N:Co 376 in trials in the southern area of the South African cane belt and is particularly suited to coastal sands, whereas in irrigated areas its sugar yields have been somewhat low, mainly because of its low sugar content; it is highly susceptible to smut and so is unsuitable for the northern area where the disease is of major importance. The cane and sugar yields from N 14 have exceeded those of N:Co 376, and the variety is resistant to most of the important and potentially important diseases, which makes it suitable for the northern area.

Root growth and characteristics of pure sugar cane varieties. E. P. Gotera, E. L. Rosario and W. G. Espada. *Sugarland,* 1980, **17,** (2), 10, 16-20. – Three cane varieties planted in wooden boxes exhibited distinct differences in root dry matter production, root distribution, rooting pattern and leaf and tiller characters up to 5 months after planting; Phil 56226 had a deeper rooting habit than Phil 58260 and Phil 6421, and developed roots earlier. Generally, more than 50% of the roots were found in the first 30 cm from the stool and within the 30 cm horizon. There was a positive and highly significant correlation between root dry weight and shoot dry weight. The cation exchange capacity (CEC) of the roots fell with time when expressed as meq/100 g but increased when expressed as meq per stool. Up to 2 months, root CEC played a role in shoot dry matter accumulation, after which its influence decreased gradually to insignificance (probably because most parts of the roots became inactive as exchange sites because of lignification). Leaf and tiller characters were closely associated with root dry weight.

Status of the Philippine sugar cane germplasm collection. A. T. Barredo and T. R. Escober. *Sugarland,* 1980, **17,** (3), 13-15, 17. – Suggestions are put forward on how to increase the Philippine cane germplasm collection (which has only 567 acquisitions compared with 2156 in the World Collection at Canal Point, Florida).

Florida's 1980 sugar cane variety census. B. Glaz and J. D. Miller. *Sugar y Azúcar,* 1980, **75,** (12), 17-19. Details are given of the principal cane varieties grown in Florida in 1971-80, with tables showing the percentages of total cane area planted to individual varieties (broken down for 1979 and 1980 into plant and ratoon cane) and number of mills or farms growing indicated percentages of given varieties. CP 63-588 is by far the predominant variety, representing 34.9% of the total area in 1980 compared with 9.6% for the next in order of preference.

Relative drought tolerance of sugar cane. O. Singh. *Maharashtra Sugar,* 1980, **5,** (12), 11, 13-15. – Trials were conducted with a number of cane varieties to find some that were suitable for growing under normal rainfed conditions (where inadequacy of rainfall is such that drought occurs). Most suitable were CoJ 67, CoJ 46 and Co 312. Details of the results are tabulated.

Photosynthetic characteristics of the different promising sugar cane varieties during the early growth period. G. R. Naik and G. V. Joshi. *Proc. 30th Ann. Conv. Deccan Sugar Tech. Assoc. (India),* 1980, (1), A.73-A.80. The crop growth rate, total photosynthetic leaf area, leaf area index, total chlorophyll content per unit weight of fresh tissue, CO_2 fixation rate and the contents of carboxylating enzymes were determined in ten cane varieties, with Co 740 used as standard. Results are tabulated and discussed.

SUGAR BEET AGRONOMY

Applications of Metamitron at different growth stages of the beet. J. M. Belien, J. F. Salembier and M. Gomand. *Publ. Trimest. Inst. Belge Amél. Betterave,* 1979, **47,** 179-194 *(French, Dutch).* — Three-year trials with Metamitron herbicide are reported. Results indicated that application as a pre- or post-emergence herbicide at 3.5 $kg.ha^{-1}$ gave effective control of a number of annual weeds, although *Anagallis arvensis* (scarlet pimpernel), *Raphanus raphanistrum* (wild radish) and *Polygonum aviculare* (knotgrass) proved difficult. While the period during which Metamitron may be applied is quite long after sowing, treatment should be avoided at beet seedling emergence and at the formation of cotyledons. Diallate at 1.2 $kg.ha^{-1}$ was a good supplement for grass weed control.

Nitrogen fertilization of sugar beet based on the nitrogen residue in the soil profile at the end of winter shows promise. G. Hofman, C. Ossemerct, O. van Cleemput, G. Ide and M. van Ruymbeke. *Publ. Trimest. Inst. Belge Amél. Betterave,* 1979, **47,** 195-210 *(French, Dutch).* Analysis of the top 125 cm of soil for nitrate N showed almost uniform distribution in the profile in mid-March and practically no loss of N by leaching or denitrification between mid-March and mid-October, while a maximum of 265 (285) $kg.ha^{-1}$ N in 1978 (and 1979) was taken up by the beet at an application rate of 75 (90) $kg.ha^{-1}$. Humus and green manure accounted for N mineralization rates of 82 and 102 $kg.ha^{-1}$ in 1978 and 1979. Beet sugar content was 17.9% and 16.7% at yields of 70.6 and 74.2 $kg.ha^{-1}$. Hence, the degree of N utilization must have been very high, and application rates based on the nitrate N content in the top 125 cm of soil may be regarded as sound.

Influence of bolting time on beet weight and bolted beet quality. K. Bürcky and U. Beiss. *Zuckerind.,* 1980, **105,** 617-620 *(German).* — Bolting time had a distinct effect on beet growth and quality — weight, sugar content and purity fell while marc content rose to a greater extent, the earlier the bolting occurred. However, no clear relationship was found between bolting time and press juice purity, although the concentrations of the various N fractions fell with earlier bolting; this was attributed to migration of N from the root to the sprouted head.

Tests on ensuring sugar beet emergence under normal practical conditions. E. Flake and W. Brinkmann. *Zuckerind.,* 1980, **105,** 755-762 *(German).* — Further trials on a number of drills and sowing techniques are described. (See also Flake & Brinkmann: *I.S.J.,* 1980, **82,** 281.)

Beet research in France. Anon. *Rpt. Inst. Tech. Betterave,* 1979, 248 pp *(French).* — Details are given of aspects of beet agricultural research in France, including spring work (soil preparation, drilling and microgranulator operation); varietal tests, fungicidal treatment of beet seed and problems with bolters; chemical weed control; pest and disease control; irrigation and nitrogen fertilization; and harvesting.

Performance and position of sugar beet within plant production in a temperate climate. C. Winner. *Die Zuckerrübe,* 1980, **29,** (5), 3-6 *(German).* — The economics of beet agronomy are discussed on the basis of both sugar and by-products profitability, with particular mention of the potential for ethanol production. Beet quality and the part played by the beet in the rotation are considered, and the production costs (in terms of both energy consumption per ha and of monetary units) evaluated and compared with those of other agricultural commodities.

What is seldom seen in perspective. W. C. von Kessel. *Die Zuckerrübe,* 1980, **29,** (5), 10-12 *(German).* — Beet yields and harvesting economics are discussed, and factors governing beet yield and profitability are examined. Forms of losses (as a result of inefficient topping, growing at field edges and respiration in storage piles) are considered, as are transport costs and frost protection late in the campaign.

Couch grass control — often a problem after late cereal cropping. Anon. *Die Zuckerrübe,* 1980, **29,** (5), 23 *(German).* — Where harvesting of grain has to be postponed because of wet conditions, couch grass grows rapidly and calls for chemical control with Roundup or TCA. Advice is given on control methods.

Sugar beet agronomy in East Germany. W. C. von Kessel. *Die Zuckerrübe,* 1980, **29,** (3), 26-28 *(German).* — A brief survey is presented of beet agriculture and processing in East Germany.

Towards a reduction in harvesting losses. A. Vigoureux. *Le Betteravier,* 1980, **14,** (145), 12-13 *(French).* — With the aid of photographs, the author indicates how losses can be reduced in leaf removal, scalping, lifting, loading and storage in clamps.

Respiration of the different parts of stored beet under aerobic and anaerobic conditions. J. Zahradnicek, M. Ondracek, S. Zikesova and A. Kotyk. *Listy Cukr.,* 1980, **96,** 193-197 *(Czech).* — The Warburg manometric method was used in respiration studies on stored beets. Under conditions of aerobic respiration (glycolysis), the highest metabolic coefficient (QO_2) was found in the subepidermal cell tissue, where the relative sucrose content was 85%. Where the sucrose content was maximum, i.e. 100% (at the apex of the central cone beneath the hypocotyl), the coefficient was 16.3% lower, and the non-sugar fraction was minimal. However, the lowest QO_2 occurred in the root tip, where the relative sucrose content was 90%. With anaerobic (intramolecular) respiration, the sucrose content was maximum in the root tip, although it was here that the respiration rate was also greatest. No correlation was found between respiration rate and sucrose content.

Potential use of retardants for chemical control of bolting in sugar beet. T. O. Pocock and J. R. Lenton. *Joint SCI/BPGRG Monograph,* 1979, (4), 41-51. — A combination of gas liquid chromatography and mass spectrometry was applied to identification of gibberellins in apices from 7200 seedlings of Bush Mono G beet

variety; the apices were extracted at the 4-leaf stage and the ethyl acetate-soluble acids purified by column and thin-layer chromatography before GLC-MS. Gibberellins A_1, A_{19}, A_{20} and A_{44} were identified. Biologically active gibberellins are associated with the earliest events leading to bolting immediately after vernalization, particularly the stimulation of cell division in the sub-apical zone of the shoot. Tests showed that Ancymidol retardant, applied weekly as a soil drench to plants from the 6-leaf stage, had limited success in controlling bolting; application of gibberellic acid to the shoot apex at weekly intervals starting one week after initial retardant treatment cancelled the effects of the retardant (delay in bolting and reduction in stem elongation). A more potent inhibitor is required to prevent gene expression after vernalization, to inhibit gibberellin biosynthesis, or modify the receptor sites that control the gibberellin-induced response.

Phosphorus fertilization of fall-planted sugar beets. J. L. Abbott and J. M. Nelson. *J. Amer. Soc. Sugar Beet Tech.*, 1980, **20**, 439-448. – The results of P fertilizer trials in 1971/72 indicate that application is recommended if soil P is below 10 ppm, as measured by extraction with $NaHCO_3$. Soil with 5-10 ppm would be adequate for seedlings growing in warm soil, but, in the case of autumn-planted beet, the petiole soluble P concentration may drop to about 1000 ppm in the cold period December-February, which leads to inadequate growth and sugar concentration. Analysing petioles for soluble P as well as nitrate is more convenient than analysing leaf blades, although P values may vary from year to year depending on climatic conditions.

Transplanted versus direct-seeded sugar beets. J. C. Theurer and D. L. Doney. *J. Amer. Soc. Sugar Beet Tech.*, 1980, **20**, 503-516. – Comparative trials were carried out on beets grown by direct sowing in the field and by transplanting of seedlings sown earlier in a greenhouse. The experiments were carried out over four years (1969-1972) and showed that leaf development was greater in the transplanted beets, but the roots were shorter and had branches which broke off during harvest, reducing yield. Further they tended to hold a higher dirt tare. The root yield was 4-7 tonnes.ha^{-1} higher, but sugar and impurity contents were not affected. The differences are not considered great enough to warrant recommendation of transplanting as a standard practice in the inter-mountain area of the western USA.

Wind erosion control. D. Bakewell. *British Sugar Beet Rev.*, 1980, **48**, (3), 7-9. – A number of techniques used to prevent wind erosion in the flat fen country of East Suffolk are described and the results illustrated with photographs. They include inter-row planting of barley which is then killed with Paraquat herbicide using a guarded band sprayer after establishment of the beet crop. Another technique is to use inert material to prevent soil movement; this may be well-rotted farmyard manure, filter cake or slurry, although in the last case the spreading must be even and fairly thin if emergence is not to be hindered or prevented. Another method is direct drilling into the stubble of a rye crop which is not removed, only a narrow row for the beet seed being cultivated with a Paratine machine and herbicide used to clean up the field before sowing.

The use of cleaner-loaders for the sugar beet crop. M. Webster. *British Sugar Beet Rev.*, 1980, **48**, (3), 10-12. – In 1979 approx. 922,000 tonnes of soil was delivered to the British sugar factories along with the beet crop, and the transport costs are estimated at over £2,000,000, while there is additionally a substantial cost to the British Sugar Corporation of removing from the factories and disposing of the soil. The use of cleaner-loaders can reduced the soil tare in beets by 50%, as shown by performance tests at some of the UK Autumn National Demonstrations, and descriptions are given of equipment used by a haulage contractor and a farmer for cleaning the beet.

A computer-based report and information system for field trials in sugar beet agriculture, integrated in ISPFLANZ. A. Mangstl, L. Reiner, A. Penger and A. Brummer. *Zuckerind.*, 1980. **105**, 846-849 *(German).* An outline is given of a system for evaluation of experimental data, for print-out in tabulated and graph form, and for storage of test data. The material is transferred annually to the ISPFLANZ data pool.

Protection of beet clamps against frost. Interest in the use of thermocouples. J. L. Lemetter. *Sucr. Franç.*, 1980, **121**, 317-328 *(French).* – Thermocouples were applied to investigations of beet clamps to determine the temperature of the stored beet under frost and post-frost conditions. While thermocouples are regarded as imprecise, they do allow rapid measurements to be made and are easily transportable. It was found better to cover clamps only a few days before the predicted onset of frost, and then only on two sides, not four. Beets lifted a few days before frost were considerably affected and deteriorated rapidly, so that such beets should be processed as soon as possible after harvesting, while those lifted during frost should be given top priority. Last to be processed should be those beets in older clamps, depending on their condition and clamp temperature. Care should be taken to avoid covering clamps when their temperature is too high, and to remove beet from clamps exhibiting one or more heat spots. The width of the clamp should not be too great relative to its height and length in order to avoid excessive temperature rise. The site chosen for clamps should be where the risk of frost is minimal, preferably where they would be exposed to winds and certainly away from sheltered spots such as afforded by trees. The investigations confirmed the value of temperature as an indicator of beet condition.

How can sugar losses be reduced during beet storage. R. Vanstallen. *Le Betteravier*, 1980, **14**, (146), 11-13 *(French).* – Four major causes of beet sugar losses during storage in clamps are examined: too high a temperature, frost damage, inefficient topping (whereby adhering leaves increase respiration and temperature rise through fermentation processes) and beet injury. To maintain the clamp temperature at a low level, it is desirable to minimize extraneous matter and restrict the clamp height to a maximum of 2 m.

Sugar beet root and sugar yield can be significantly increased. S. Varga, V. Szirtes and A. Kovacs. *Cukoripar*, 1980, **33**, 81-83 *(Hungarian).* – Spraying beet leaves with Rol-Fruct (an ethylene-generating chemical) at a dilution of up to 1 ml.litre^{-1} and a rate of up to 1 litre.ha^{-1} in August, when leaf size was maximum, inhibited further growth and allowed the root to develop, resulting in a substantial increase in sugar yield, despite a slight drop in the sugar content. With increase

in the Rol-Fruct concentration beyond 1 $ml.l^{-1}$ there was a rise in the Na^+ and α-amino-N concentrations, while the sugar content fell significantly; these effects were similar to those in beets exposed to moisture, heat and salinity stress.

Losses as a function of sugar beet topping quality. Z. Izsaki. *Cukoripar,* 1980, **33,** 84-88 *(Hungarian).* The effect of unsatisfactory topping on beet returns and transport costs is discussed, and investigations reported in which it was found that 55% of the beets were cut below the optimum level and represented a 4 $tonnes.ha^{-1}$ loss in root yield; of this, 1.32 $tonnes.ha^{-1}$ was lost in just 8% of the crop, where the beets were topped 4 cm below the optimum level.

The influence of some factors on sugar beet quality. Z. Stanescu and P. Stefanescu. *Prod. Veg., Cer. si Plante Tehn.,* 1980, **32,** (9), 46-48 *(Rumanian).* — The effects of climatic factors, fertilization and plant population on beet quality are discussed.

What weeds could appear in a sugar beet crop? J. M. Belien and J. F. Salembier. *Le Betteravier,* 1980, **14,** (147), 14 *(French).* — Annual broad-leaf weeds and grasses observed during 20 years on untreated test plots are listed together with the numbers found per m^2 and frequency of occurrence (ranging from every year to once every four years). Growers are advised to formulate a weed control program based on the findings, particularly where the frequency is every year and every two years.

Economics, productivity and competitiveness of sugar beet growing. Technical and economic analysis. G. Kitsopanide, A. Psuchoudake, I. Karpaze, E. Papanagiotou, B. Manou and E. Anagnostopoulou. *Hellenic Sugar Ind. Quarterly Bull.,* 1980, (41), 109-199 *(Greek).* — The history of sugar beet agriculture in Greece is briefly surveyed, and a technico-economic analysis made of beet growing on 727 farms in different areas of the country. Competitiveness with other crops such as cotton, wheat, maize and lucerne is examined, as well as the economics of mechanical harvesting (based on data supplied relating to 56 harvesters).

Possibilities and limitations of reducing dirt tare in sugar beet harvesters. W. Brinkmann. *Die Zuckerrübe,* 1980, **29,** (6), 18-21 *(German).* — Means of removing adhering soil from beets as they are handled by harvesters are described with the aid of illustrations.

Topography of the chemical composition of the sugar beet root. IV. Topo-chemistry of the sugar beet under the effect of different water regimes during harvesting and after storage. J. Zahradnicek, S. Fiedlerova and V. Svachula. *Listy Cukr.,* 1980, **96,** 241-252 *(Czech).* The sugar, α-amino-N and conductimetric ash contents were determined in 16 zones of the roots of beets grown under four different water regimes, viz. excessive irrigation, sufficient irrigation to meet the moisture and growth requirements, no irrigation (with reliance on rain only), and complete deprivation of water (with the beets grown under cover). The maximum sugar content at harvest was found in the central parts of the roots, whereas after 75 days' storage it was found in the very bottom of the root, this downward movement being most marked in the over-irrigated beets. In the second of the two years of the investigations, the beets subjected to moisture stress exhibited an upward movement of the maximum sugar content after storage. Significant differences occurred in the α-amino-N content between the beets as a function of treatment, and in all cases the greatest ash content before and after storage was found in the middle part of the epicotyl.

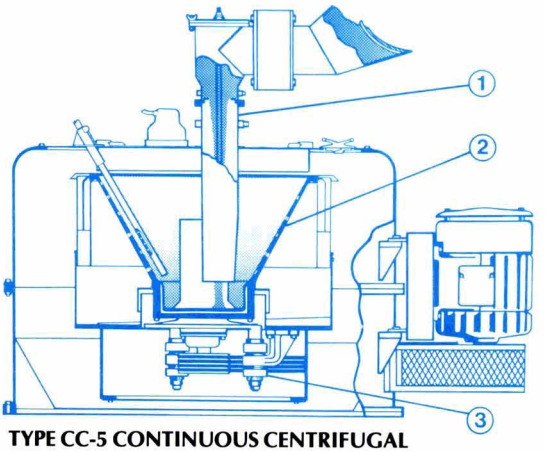
The rational use of pig manure for sugar beet growing. Results from experimental plots in 1978 and 1979. R. Boon. *Sucr. Belge,* 1980, **99,** 423-434 *(French).* Trials at two sites in Belgium are reported. Application of 60,000 $litres.ha^{-1}$ of pig manure in spring (end-February to start of March) without supplementary fertilizer gave higher root yields, satisfactory sugar contents and low noxious N contents by comparison with unfertilized controls or beets to which up to 240 $kg.ha^{-1}$ of N as ammonium nitrate plus P and K was applied. On the other hand, late-season application of the same quantity of pig manure gave poorer results (about the same as given by 240 $kg.ha^{-1}$ N applied at the same time of the year), although leaf growth was greater than after spring applications as a result of failure of the beets to assimilate N from September onwards. This prevented normal ripening, by contrast with the situation after spring application, where absorption of N from the upper layers of the soil at the end of August caused the leaves to yellow and the beets to ripen.

Plant establishment in 1980. M. Durrant. *British Sugar Beet Rev.,* 1980, **48,** (4), 7-10. — Studies on a large number of beet fields showed that an average of 4% of seed positions were vacant as a result of drill misses, 8% contained non-viable seeds, while as much as 18% contained seed which germinated but did not emerge. An average 7% of seedlings were lost as a result of wind damage and the activities of pests, particularly birds. Differences were found in germination time between sites as a result of differences in soil and drilling depth; it is emphasized that germination and emergence must be rapid for minimum pest damage and maximum radiation interception. A minimum of 70% establishment of seed is required in order to avoid yield losses caused by gappiness; hence, the total average losses mentioned above would result in a crop yield loss. Close agreement was found between laboratory and field germination.

Oats *vs.* the blow. M. Atkinson. *British Sugar Beet Rev.,* 1980, **48,** (4), 17. — Beet fields in East Anglia were protected from wind blowing by drilling oats three weeks before drilling of the beet; the oats were drilled at right-angles to the intended direction of the beet rows. The herbicide Clout, at 1.25 $kg.ha^{-1}$ per application, was applied in two stages to kill the oats, the first application being made when the oats had about three leaves, and the second application when they were in the mid-to-late tiller stage, by which time the beets were big enough to withstand the wind. Final inter-row removal of oats was accomplished with a rotary hoe. Broadcasting oats (at the same rate as in row drilling) failed to hold the soil because of lack of row continuity. The entire treatment, using inexpensive oat seed, cost only £20 per acre, and was effective in giving better beet growth with considerably reduced damage.

Sugar beet at Terrington experimental husbandry farm. C. Hayward. *British Sugar Beet Rev.,* 1980, **48,** (4), 25-26. — Results of trials on various aspects of beet agronomy are briefly discussed, covering seedbed preparation, drilling, autumn cultivation, seed treatment and fertilization.

Designed with high capacity in mind.



TYPE CC-5 CONTINUOUS CENTRIFUGAL

CAPACITY PLUS! It's designed and built into Western States Continuous Centrifugals.

Proven by extensive experience, the Type CC-5 feeding/pretreatment system **(1)** is the prime key to CAPACITY PLUS. The enclosed and directed feed stream insures a steady introduction of massecuite to the basket's loading bowl. The built-in arrangement for massecuite pretreatment provides the final lubricating and heating to obtain highest-quality products from even the most viscous massecuite encountered.

The Type CC-5 solid, cast stainless steel conical basket **(2)** is another key to CAPACITY PLUS. Efficient separation is the fundamental purpose of the continuous centrifugal and drainage holes from bottom to top of the CC-5 basket assure earliest possible elimination of molasses. Power input is thus more effectively used for higher production of product.

Smooth operation is provided by the tripod support system **(3)** incorporating adjustable rubber buffers for dampening vibration. This support system minimizes mechanical problems and enhances CAPACITY PLUS performance.

Get the entire money-making CAPACITY PLUS story today. Contact us or your local Western States representative and find out what the Western States Type CC-5 Continuous Centrifugal can do for you!

THE WESTERN STATES MACHINE COMPANY
Hamilton, Ohio 45012 U.S.A.
ROBERTS CENTRIFUGALS

capaci

ty plus

CANE SUGAR MANUFACTURE

The application of a microprocessor-based system for automatic pan boiling control. D. J. Tayfield, P. W. Rein and S. R. Proome. *Proc. 54th Ann. Congr. S. African Sugar Tech. Assoc.*, 1980, 56-62. – An account is given of the adoption of automatic control of four pans at Amatikulu by means of a microprocessor-based system which governs boiling in response to signals from level switches in the pan, vapour space absolute pressure and calandria steam pressure switches, a vapour temperature transmitter and transmitter for pan contents conductivity. The control unit adjusts valves controlling injection water, syrup/molasses feed and water feed to the pan, and has improved crystal quality appreciably. Problems that have arisen are discussed and an indication given of changes to be made in extending the system to other pans.

Anomalies in the measurement of *A*-massecuite volumes and exhaustion. A. F. Currie and J. P. M. de Robillard. *Proc. 54th Ann. Congr. S. African Sugar Tech. Assoc.*, 1980, 77-78. – A regular discrepancy between massecuite volumes as reported by the mill and calculated volumes led to an investigation which established that a certain amount of massecuite remained in the pan after each strike (giving an error of 4.8%) and that reported exhaustions were too high owing to incorrect sampling methods.

The effect of sodium hydrosulphite on final massecuite viscosity. P. L. M. Vermeulen. *Proc. 54th Ann. Congr. S. African Sugar Tech. Assoc.*, 1980, 87-88. – Tests were carried out during which sodium hydrosulphite was added to final strikes, half before graining and half after cutting into the strike pan, in alternate weeks during August-December 1979. Previous work had shown that Brix was increased by 0.3 units and boiling times reduced by ½ hr, and the reported tests show that viscosity was reduced by about 40% at a cost of 9.5 cents per m^3 of massecuite.

Practical tracers for the sugar industry – the analytical feasibility of using lithium, chloride or potassium. P. G. Morel du Boil. *Proc. 54th Ann. Congr. S. African Sugar Tech. Assoc.*, 1980, 99-104. – A series of experiments has been carried out to determine the applicability of the three title tracers for examining flow patterns or other changes in sugar processing. Accuracy, precision, advantages and disadvantages are discussed. In general, chloride is an ideal natural tracer but tends to be underestimated where mercuric salts are used for preservation of samples. Potassium is less reliable, particularly if conventional preservatives are employed; if the juice preservative does not contain K or Cl, both are probably equally effective for preserved juices. Lithium determined by flame emission gives good precision provided samples contain KNO_3, although with low-purity products Li is under-estimated by about 3%; however this may be avoided by using a nitrous oxide-acetylene flame.

Steam and power generation at Davies Hamakua Sugar Company. B. Ross. *Rpts. Hawaiian Sugar Tech.*, 1979, 120-122. – An account is given of the installation and operation of boilers and generators at the Laupahoehoe and Honokaa sugar factories whereby bagasse energy recovery efficiency has been raised markedly and the company is contracted to supply power to the local utility at peaks up to 10 MW. A secondary project involves the production and storage of some 15,000 short tons of bagasse pellets during the crushing season; these are of 8-10% moisture content and have a higher calorific value than fresh bagasse while being more stable, and are expected to eliminate particulate chimney stack emissions.

Power factor correction at Hawaiian Commercial & Sugar Company. W. Raupp. *Rpts. Hawaiian Sugar Tech.*, 1979, 123-129. – The induction motors used in sugar factories have a relatively low power factor, and steps are described which are aimed at raising it in order to improve the fuel utilization efficiency of the factory. Since the power factor is lower at light loadings, the first step is to match the motors to the duty so that the load and power factor are higher. Where possible, synchronous motors are employed, e.g. in deep well pumps, although they are not very practical inside the factory. The main method is, however, installation of power factor capacitors individually at the load (rather than as a bank of capacitors at the bus). The appropriate US Electric Code provisions and precautions in the use of the capacitors are mentioned, as are the results achieved. The cost of the units is expected to be recovered in just under 1½ years.

Dryer operation at Waialua Sugar Company. C. Shishido. *Rpts. Hawaiian Sugar Tech.*, 1979, 130-132. – Despite ambient air leakage (which reduced the temperature of gas from 607°F at the boiler to 472°F at the bagasse dryer inlet) and the consequent low efficiency, the bagasse moisture was reduced from 47.8 to 33.5%, which permitted a rise in boiler efficiency from 64.3 to 68.9%, with a saving of 4.73 short tons of bagasse per hour at 50% moisture. At the same time, stack gas opacity was reduced by 10%.

Bagasse drying at Waialua Sugar Company. G. Fraser. *Rpts. Hawaiian Sugar Tech.*, 1979, 133-136. – Increased demand for electrical power for irrigation pumps on new land coincided with higher fuel costs, and it was calculated that, by drying bagasse with flue gas, boiler efficiency could be increased and the need to purchase supplementary fuel avoided (see previous abstract). This has been done and the annual savings are calculated as $345,000 for an investment cost of $875,000.

Further factory sulphitation test at Puna 1978-1979. K. Onna and R. Tamaye. *Rpts. Hawaiian Sugar Tech.*, 1979, 141-143. – Comparative trials were carried out in which clarification was by lime alone for 2 weeks, then lime + sulphitation for 2 weeks, and then both repeated for 4-week periods. The object was to measure mild steel corrosion in the evaporator condensate system resulting from sulphitation, and to obtain more data on sugar recovery and quality. Although corrosion was greater, it was concluded that this was caused by injection of air into the condensate and not by sulphitation. Compared with liming alone, sulphitation raised sugar pol (98.99

vs. 98.91) and reduced moisture (0.18 *vs.* 0.22%) and crystal colour (8.3 *vs.* 12.3). Recovery (*s-j-m*) from *A*-strikes rose from 63.96 to 64.74% and from *B*-strikes from 53.07 to 54.37%. If the SO_2 used is produced by burning sulphur, the benefits outweigh the cost by $2.08 per ton of sugar; if liquid SO_2 is used, the net benefit is reduced to $1.01 per ton.

Steam/vapour side cleaning of heat transfer equipment. J. C. P. Chen. *Rpts. Hawaiian Sugar Tech.,* 1979, 144-148. Although deposition of scale from juice and its removal from the tubes of heat exchange plant are commonplace, deposition also occurs on the steam side in calandrias, etc. and includes oil films when lubricants are entrained in low-pressure exhaust steam, iron oxide and corrosion products from the tube metal, traces of calcium compounds and silicic acid, fatty acids and lipids steam-distilled from cane wax, etc. Amounts can be as high as 20 $g.m^{-2}$ Methods used for cleaning include treatment with gasoline or kerosene (which removes oil material), chelating agents, caustic soda or carbon tetrachloride, or addition of molasses which is allowed to ferment. A new treatment has been developed which involves use of two unspecified solutions, one of which attacks organic material and loosens deposits while the second removes the inorganic constituents. The effects of the treatment are illustrated by photographs of tubes.

Special hard-facing of cane shredding hammers. R. De Francisco and W. Ayala. *Rpts. Hawaiian Sugar Tech.,* 1979, 149-150. — Because of rocks in the cane supply, the maintenance schedule at Puna Sugar Co. involved changing shredder hammers on Thursday and Monday mornings and changing fiberizer hammers on Monday mornings. The hammer length would be rebuilt to its original length, by between ½ and 2 inches of metal. A new system introduced in 1977 consists of mould-casting the hammers, which are inserted in a copper- or carbon-clad steel mould in which the hard-facing alloys are melted continuously until the proper hammer length is achieved. Although rebuilding a hammer takes 4.2 hours instead of 1.5 hours by the old method, the hammer lasts 6 times as long, and maintenance is cheaper.

Material balance relationships in centrifugal washing. G. E. Sloane. *Rpts. Hawaiian Sugar Tech.,* 1979, 151-163. — Tests were conducted at Kekaha Sugar Co. to examine various indices of washing efficiency in centrifugals. The amounts of impurities and sugar dissolved may be calculated from analysis of the original massecuite, molasses, wash, etc., but the values are very sensitive to small errors, so that accuracy and adequate sampling are essential. Massecuite characteristics vary during purging, and representative molasses sampling is difficult. Further tests are to be made using improved sampling methods as well as material balance relationships (used to compare the efficiency of double washing against single washing).

Solar drying of trash. J. D. Carruthers. *Rpts. Hawaiian Sugar Tech.,* 1979, 169-170. — Cane leaf trash removed by the cane cleaner at Puna was left in the open. Its water content fell to less than 30% within three months, when it was highly suitable as a fuel, replacing supplementary oil. An account is given of the operation, which has presented few problems except in dust control.

Laupahoehoe boiler wet scrubber. J. Bersch. *Rpts. Hawaiian Sugar Tech.,* 1979, 171-173. — To avoid the need to transport cane trash back to the fields, a boiler-incinerator was ordered in 1971; it was to be fired by a mixture of trash and bagasse. Emission tests in 1976 showed that the abrasive ash produced had worn out the fractionator/collector, which had to be repaired. The boiler still gave particulate emissions higher than the legal limit at times, and many modifications were made to prevent this; however, in 1977 it was concluded that all the gases would have to pass through a wet scrubber. Eventually one was provided by Neptune/Airpol of New Jersey, and this and its successful application are described.

Lihue power plant update and load dispatch system. A. M. Miyamoto. *Rpts. Hawaiian Sugar Tech.,* 1979, 174-176. — An account is given of the start-up of the Lihue power plant[1]. Lihue Plantation Co. Ltd. operates the plant, which is owned by Foster Wheeler Kauai Inc. and is contracted to supply electricity during the season to Kauai Electric Co. during the season. By means of two examples it is shown that problems could arise in the event of an upset in the utility system.

Sugar cane: determining quality factors of the raw material. F. A. Fogliata and M. O. Haro. *La Ind. Azuc.,* 1980, **86,** 124-126, 138, 166-169 *(Spanish).* — The factors determining cane quality are: pol % first expressed juice, apparent purity of first expressed juice, fibre % cane and reducing sugars % cane. The consequence of the first two is that Brix of first expressed juice is also an important factor. Average values for two-week periods from the second half of May to the first half of December are tabulated for Tucumán factories for the periods 1957-67, 1968-79 and 1957-79 (data from before mid-May and after mid-December are ignored), and show the progress of ripening. In the period 1957-67 the highest Brix (18.189°) was reached in the latter half of November; in 1968-79 the peak (19.669°) was reached a month earlier. The effects of frost are briefly mentioned. Pol % first expressed juice followed a similar pattern for the two periods, but the rates of change were different, so that apparent purity reached a maximum for both periods in the second half of July. By contrast, reducing sugars % juice fell to a minimum in the second half of June in the earlier period and in the first half of July in the second. Fibre % cane did not follow a regular progression but tended to increase slowly during May-September, thereafter increasing more rapidly as the season advanced.

Boiling of sugar solutions. Bibliographic study. S. Marrero A. and R. Alemán G. *Centro Azúcar,* 1979, **6,** (3), 23-29 *(Spanish).* — A study of some of the literature on sugar boiling has been made in respect of a number of factors, including viscosity, influence of non-sugars and of mechanical circulation, vacuum, surfactants and Brix. Twenty-three references are included, and further studies which should be made are briefly discussed.

Problems of the perfecting of calculation of the cost of production of raw sugar under conditions of economic calculation. E. Rodríguez L. and V. G. Linnik. *Centro Azúcar,* 1979, **6,** (3), 37-52 *(Spanish).* — A method new to Cuba is examined in which the value of molasses as a by-product is taken into consideration in calculation of the cost of production of raw sugar.

[1] McCraw: *I.S.J.,* 1981, **83,** 53.

Influence of some chemical agents added to the surface of cane juice undergoing the process of sedimentation. P. M. Fabregat P., R. Reyes E. and R. González R. *Centro Azúcar,* 1979, **6,** (3), 53-65 *(Spanish).* – Application of a 1 mm thick film of oil to juice in a pilot plant clarifier and the spraying on its surface of 10 litres.hr^{-1} of cold water (at 23-27°C) over an area of 1.20m^2 were examined to determine their effects on the juice. It was established that both treatments improved juice quality and permitted a shorter retention time, the cold water spray being the more effective.

Chlorine treatment for mud ponds and mill sanitation. I. E. Legendre. *Sugar* J., 1980, **43,** (3), 15. – Information is given on the system used in the application of chlorine solution to the cane mat on the carrier preceding the shredder and to the mud mixing tank at the author's factory. Use of 50 lb/day has effectively controlled *Leuconostoc mesenteroides,* with resultant improvement in raw sugar quality, while eliminating odour from the mud pits.

The double magma system: a report of its performance and experiments with it at United States Sugar Corporation. B. M. Rodriguez. *Sugar J.,* 1980, **43,** (3), 16-21. Details are given of the double magma schemes used at Clewiston and Bryant sugar factories. Aimed at overcoming problems created by mechanical harvesting of the cane and cane harvested under adverse weather conditions, the system was introduced at the time of increase in the crushing capacities of both factories. Advantages of the scheme over the previous three-boiling system are indicated.

The scientific computer in sugar factories. E. M. Hine. *Sugar y Azúcar,* 1980, **75,** (10), 25, 28-29. – Application of computers to processing of cane sampling data and supplying of the cane farmer with cane delivery and analytical records, to processing of laboratory data, to provision of factory and/or refinery balances and inventories of materials in process, and to process monitoring and control is discussed.

The Borotou Koro sugar complex: an example of energy economy in the cane sugar industry. J. de Cremoux and P. Lombard. *Ind. Alim. Agric.,* 1980, **97,** 747-749 *(French).* – In its first season, the 3600-tcd factory at Borotou Koro, erected by Fives-Cail Babcock in Ivory Coast, consumed 380 kg of steam per tonne of cane crushed, by comparison with a target consumption of 405 kg/tonne; while the actual consumption is well below the levels usual for cane sugar factories, it is still considered higher than could be achieved. Details are given of the steam generation plant, of the quintuple-effect evaporator and of the turbo-alternator sets for electricity generation. It is aimed to produce 45 kW.hr^{-1} per tonne of cane as supplementary power for external use.

Water management and effluent prevention in a sugar factory. G. K. Chetty. *Maharashtra Sugar,* 1980, **5,** (10), 33, 35-37. – Advice is given on water management in a sugar factory with the aim of minimizing the quantity of water that becomes contaminated and hence discharged as effluent.

Sugar mill wastes and pollution control. M. E. Rao, K. L. Narayana, P. G. Sastry and T. S. N. Murthy. *Indian Sugar,* 1980, **29,** 69-72. – Means of reducing the pollutant level in cane sugar factory effluent and decreasing water wastage are briefly discussed.

Raw sugar factory manufacturing reports and factory performance. H. S. Birkett. *Sugar Bull.,* 1980, **52,** (23), 7, 14; (24), 10. – It is stated that several sugar factories (including those in Louisiana) have limited weighing facilities, so that factory reports may not be sufficiently accurate. The author discusses methods that can be used to determine the accuracy of such reports, and suggests means of determining the errors. The methods include: calculation of a pol and a solids balance; comparing the weighted average purity of sugar, final molasses and filter cake with that of mixed juice; comparing the weighted average purity of sugar and final molasses with that of the syrup; comparing theoretical sugar yield and final molasses production with the reported figures; determining the purity of the undetermined losses; and calculating the absolute juice Brix: crusher juice Brix ratio.

Energy inventory for Hawaiian sugar factories:1978. D. Murata. *Hawaiian Planters' Record,* 1980, **59,** 177-194. – Since the last energy inventory for Hawaiian sugar factories in 1975[1] the number of factories has fallen, and the resulting consolidation of cane processing at the remaining factories has significantly altered the steam generation requirements. Tables are reproduced showing availability and utilization of bagasse and other fuels at the different factories, and electricity generation plant and amount produced for use in factory and field as well as surplus available for sale to the public grid.

Reducing maintenance costs of shredder hammers and cane knives. A. Koen. *S. African Sugar J.,* 1980, **64,** 483, 487, 489. – See *I.S.J.,* 1982, **84,** 22.

Energy inventory for Hawaiian sugar factories: 1978. D. Murata. *Sugar y Azúcar,* 1980, **75,** (12), 30, 34-35, 38-39. – See abstract on this page.

Practical aspects of cane diffusion. J. P. Lamusse. *Sugar Tech. Rev.,* 1980, **7,** 197-253. – A survey is presented of cane diffusion, including makes and types of diffuser, factors affecting diffusion, cane preparation, bagasse dewatering, diffuser operation, the effect of diffusion on subsequent juice processing and sugar recovery, and the economics involved.

True seeding of low-grade massecuites. S. Maiti, N. Pal and M. Singh. *Proc. 30th Ann. Conv. Deccan Sugar Tech. Assoc. (India),* 1980, (1), M.1-M.12. – A seed slurry, obtained by the conventional method of grinding sugar in a ball mill in which alcohol is introduced, improved low-grade massecuite exhaustion by 1.5 units and gave a *C*-sugar of 1.9 units higher purity than did a slurry prepared by adding rectified spirit to syrup to recrystallize sugar which was then treated in a ball mill.

Manganese sulphate as process additive in low-grade massecuite boiling. M. Singh, G. S. C. Rao and I. B. Adarkatti. *Proc. 30th Ann. Conv. Deccan Sugar Tech. Assoc. (India),* 1980, (1), M.13-M.22. – Addition of 50 ppm $MnSO_4$ to low-grade massecuite in a laboratory and factory-scale pan gave an approximate 1 unit increase in molasses exhaustion by comparison with the control, while the purity drop during crystallization on a factory scale increased by 27%.

[1] *I.S.J.,* 1979, **81,** 21.

BEET SUGAR MANUFACTURE

Reduction of flue gas losses. H. Huber. *Zuckerind.*, 1980, **105**, 895-900 *(German)*. – Flue gas heat losses (non-utilized primary energy) occur almost exclusively in steam generation and pulp drying. The author examines the economics of these losses and investigates the cost effects of the air factor, flue gas temperature, incomplete combustion and utilization of flue gas heat. Comparison is made between complete and incomplete combustion in a hypothetical case which approximates very closely to real conditions. The use of boiler flue gas in pulp drying is discussed, and optimum specific gas quantities calculated for loads of **40, 60,** 80 and 100%. Advice is given on measures to minimize flue gas heat losses.

The influence of colour and ash content of syrups on white sugar quality. A. Rossi and V. Maurandi. *Zuckerind.*, 1980, **105**, 906-910. – See *I.S.J.*, 1981, **83**, 342.

Raw juice purification at Ramon sugar factory. V. M. Fursov, V. E. Apasov, A. R. Sapronov and V. A. Golybin. *Sakhar. Prom.*, 1980, (10), 17-18 *(Russian)*. – Raw juice was prelimed at 50-60°C in a Brieghel-Müller trough, 0.25% lime on weight of beet being added at the bottom of the last compartment, while 70-100% 1st carbonatation juice was returned to that compartment where the juice attained a pH_{20} of 9.0. Retention time was 15 min (not including the time taken for carbonatation juice recycling). The juice was then subjected to liming for 10 min in a vertical tank, heated to 80-85°C and subsequently passed through a series of three vertical vesssels during a total retention time of 18-20 min before transfer to carbonatation. Mud from the prelimer and the series of three main limers was collected in a tank and pumped to the independent limer. Results showed that the colour of the juice was 10-40% lower and of evaporator thick juice 20-50% lower than with a scheme of hot preliming (at 80-85°C) for 4 min and hot main liming for 14 min. The lime consumption was 10-18% lower with the new scheme.

The processing efficiency of the purification scheme at No. 2 "Petrovsk" sugar factory. N. V. Remeslo, G. P. Voloshanenko, L. D. Bobrovnik, Yu. F. Tsyukalo and Z. S. Kirpenko. *Sakhar. Prom.*, 1980, (10), 19-22 *(Russian)*. – Investigations are reported which demonstrated the adverse effects of nucleic acids on juice properties. While addition of nucleosides to raw juice caused a fall in 2nd carbonatation juice purity, the most noticeable negative effect was that of specific nucleosides on colour. Liming and preliming trials showed that addition of 1.75% CaO in main liming (at a total usage of 2.35% CaO) permitted maximum separation of nucleic acids and their degradation products. The colloids content (strongly linked with the presence of nucleic acids) also fell, as did colour. Preliming was carried out at 50-55°C, while main liming was conducted as a fractional process at this temperature and a higher one; a second liming stage was carried out before 2nd carbonatation.

Industrial trials on a new design of thin-film clarifier at Kobelyakskii sugar factory. V. S. Bondarenko, N. I. Nespryad'ko, I. A. Oleinik, I. G. Bazhal and R. M. Polishchuk. *Sakhar. Prom.*, 1980, (10), 22-24 *(Russian)*. – The new clarifier tested consists of a vertical vessel in which a series of five conical plates (each in the form of a large funnel) are spaced vertically apart at regular intervals, forming four thin-film sections across the width of the vessel, with juice discharge ports on each side of every section. A vertical tube is contiguous with the lower rim of each conical plate. The lower part of the clarifier is conical and ends in the top of a mud collector which feeds the mud to vacuum filters. First carbonatation juice is fed at the top of the clarifier and enters the central tube, whence it flows in a film over the plates, while the separated mud passes down through the tube to the collector. Results of the tests indicated a faster settling rate and improved filtration of the juice as well as lower mud volume, colour and lime salts contents and higher purity, by comparison with a conventional Soviet clarifier.

Effect of aluminium ions on the albumin content in raw juice. Yu. B. Navrotskii and A. A. Lipets. *Sakhar. Prom.*, 1980, (10), 25-26 *(Russian)*. – Albumins readily form compounds with ions of polyvalent and heavy metals, which may then be precipitated. Experiments were conducted on the suitability of diffusion water treatment with aluminium sulphate as a source of the Al^{+++} ion and hence a possible means of reducing the albumin content. At an extraction water pH of 5 and a diffusion time of 60 or 90 min, the albumin content was lower than when SO_2 was used for water treatment, the results staying constant with increase in the time when aluminium sulphate was used but increasing markedly with use of SO_2. Increase in the water pH to 6 raised the albumin content with both water treatments, although SO_2 treatment was still inferior in terms of albumin content. At pH 5-5.5, acid degradation of sucrose would be insignificant, it is suggested, because of the relatively short contact time and small amount of sugar in both the cossettes and extraction liquid at the end of the diffuser.

Intensification of 1st carbonatation juice settling with active silicic acid. I. F. Bugaenko, T. N. Samoilova, A. R. Sapronov, Yu. I. Veitser and E. I. Gervits. *Sakhar. Prom.*, 1980, (10), 26-28 *(Russian)*. – In flocculation tests, active silicic acid (a polymer of the acid) gave a faster settling rate with 1st carbonatation juice than polyacrylamide, although the final mud volume was almost the same for both flocculants. Best results were given by a dosage of 2 $mg.l^{-1}$.

Investigation of scale composition in an experimental MTIPP film-type evaporator. V. D. Lazarev and M. S. Zhigalov. *Sakhar. Prom.*, 1980, (10), 38-41 *(Russian)*. – Analysis of the scale deposited on the steel tubes of a quadruple-effect film-type evaporator showed that, as in conventional sugar factory evaporators, the largest component was CaO (69% by weight of the non-ashed sample taken from the 1st effect), followed by 12.3% organic compounds, 4.2% $CaSO_4$, 3.1% oxalic acid, 2.5% SO_3, 2.0% SO_2, 2.0% MgO, 1.7% Al_2O_3 + Fe_2O_3, 1.4% P_2O_5 and 1.2% SiO_2. The CaO percentage

fell with each effect, while the oxalic acid and organic compounds concentrations rose appreciably.

Determination of the heat exchange characteristics of externally heated diffusers. S. P. Tsygankov. *Sakhar. Prom.*, 1980, (10), 41-43 *(Russian).* — A method of calculating the main heat exchange parameters and of determining the temperatures of juice and cossettes in a twin-scroll A1-PDS-20 inclined trough diffuser is described, and comparison is made with the values of parameters found for DDS diffusers.

An important condition for reducing the molasses sugar content. N. N. Neklyudova and G. F. Tyazhelova. *Sakhar. Prom.*, 1980, (10), 43-47 *(Russian).* — A description is given of an air-bubble viscometer which was applied to measurements of minimum and maximum viscosity at 40°C of 82°Bx undiluted molasses samples from different sugar factories. The constant for the instrument varied with factory, so that the viscometer needs to be calibrated at each individual plant.

Certain measures for reducing sugar losses during manufacture at factories in the Lipets sugar industry group. A. S. Turkina. *Sakhar. Prom.*, 1980, (10), 47-48 *(Russian).* — Equipment and processes contributing to a reduction in sugar losses at four named sugar factories are discussed.

Research on and development of centrifugals in the sugar industry. J. Fiedler. *Listy Cukr.*, 1980, **96**, 219-225 *(Czech).* — Developments in the field of centrifugal design and manufacture in Czechoslovakia are described. Details are given of modifications to the ARO series of batch machines, and the principle on which a blade-type continuous centrifugal is based is explained. Trials with a prototype machine have shown that it gives results with low-grade massecuite that are comparable to those achieved with an ARO 850 batch centrifugal in terms of *C*-sugar yield, purity and ash content and molasses purity.

The AR-10 beet slicer capacity regulator. A. Havlin and V. Valter. *Listy Cukr.*, 1980, **96**, 226-227 *(Czech).* — A description is given of an electronic regulator which acts on the slicer in accordance with a signal received from the cossette belt weigher so as to increase or decrease the feed and thereby maintain a steady flow to the diffuser. Trials have confirmed the reliability of the regulator.

Innovation in beet reception for dry piling at Hrochuv Tynec sugar factory. J. Ruzicka and J. Hluze. *Listy Cukr.*, 1980, **96**, 228-231 *(Czech).* — The system installed at Hrochuv Tynec in 1978 comprises two parallel rows of hoppers (each consisting of six hoppers) into which the beets are unloaded by tipping or use of water jets. A vibratory feeder at the bottom of each hopper ejects the beets onto a belt conveyor which transfers them to a main belt conveyor at 90° to it; the beets are then conveyed to a distribution point for piling. Advantages of this underground system are listed.

The rate of carbon dioxide adsorption under conditions of continuous 1st and 2nd carbonatation. II. Factors affecting carbon dioxide solubility. E. Sarka. *Listy Cukr.*, 1980, **96**, 231-233, 240 A *(Czech).* — Factors affecting the value of Henry's constant were examined. Under carbonatation conditions, the concentration of sucrose and dissociated molecules in the juice caused variation in the constant for CO_2 by a maximum of ± 5%. The constant fell with temperature rise in the range 40-90°C, but this effect was balanced by a many-fold increase in the rate constant of CO_2 hydration with temperature.

Measurement of massecuite viscosity. M. Brandejsky, D. Havelkova, F. Rieger and J. Gebler. *Listy Cukr.*, 1980, **96**, 234-237 *(Czech).* — Comparison was made between a vertical scroll-type mixer and a coaxial cylinder as components of a viscometer for measurement of massecuite viscosity. The theory on which the former type is based is explained. Tests with intermediate and low-grade massecuite showed that the two systems gave similar results when the time intervals between measurements were short, but that at longer intervals there was a tendency for crystals to separate out when the cylindrical system was used, thus reducing measuring accuracy. The scroll system afforded good mixing under all test conditions.

Study of tables relating to water vapour. Mathematical formulation and practical use. J. Genotelle. *Sucr. Franç.*, 1980, **121**, 357-367 *(French).* — Formulae are given for a number of steam parameters, including the temperature-pressure relationship; enthalpy, entropy and volume of dry saturated, wet and superheated steam; heat of vaporization; and specific heat. Tables of values are given, and practical application of the formulae is briefly demonstrated.

Kinetics of reducing matter degradation in raw juice during main liming. V. A. Kolesnikov, D. M. Leibovich, G. I. Gorokhov and V. A. Maksyutov. *Izv. Vuzov, Pishch. Tekh.*, 1980, (4), 62-64 *(Russian).* — Results of experiments carried out to determine the degradation rate constants of fructose and glucose in raw juice during liming under controlled conditions are discussed and values of the constants tabulated for 50, 60, 70, 80 and 90°C (those for the last two temperatures being extrapolated). Reducing sugar degradation was found to be the sum of irreversible monomolecular chemical reactions definable by 1st order equations. From the constants, the energy of activation was calculated as 85.3 $kJ.mole^{-1}$ for glucose and 65.2 $kJ.mole^{-1}$ for fructose.

Filtration of sugar syrups decolorized with granular active carbons. Ya. O. Kravets, A. S. Soroka and G. I. Zazimko. *Sakhar. Prom.*, 1980, (11), 22-24 *(Russian).* — Filtration experiments were conducted on syrup that had been treated with granular active carbon in continuous, counter-current adsorption towers. Expanded perlite was used as filter medium in a set of candle filters provided with vibratory means of mud discharge and precoat application. Results showed that at a throughput of 0.20-0.45 $m^3.m^{-2}.hr^{-1}$, a Brix of 47-63° and a temperature of 67-78°C, turbidity was reduced to a level (<100 units) which was virtually constant over 20 cycles, irrespective of the initial level (190-1360 units), since filtration efficiency rose with increase in the initial turbidity and reached a maximum of 92%.

Optimization of beet slicer parameters on the basis of simulation. V. G. Belik and A. M. Shcherbakov. *Sakhar. Prom.*, 1980, (11), 25-27 *(Russian).* — On the basis of equations defining the energy and material balances of a beet slicer, an algorithm was prepared for simulation of slicer operation. Calculated values were found to be in close agreement with experimental values for a given slicer of Soviet design.

Polysaccharides in raw juice. K. P. Zakharov, R. G. Zhizhina, V. Z. Semenenko and V. Z. Nakhodkina. *Sakhar. Prom.,* 1980, (11), 27-29 *(Russian).* — Details are given of a procedure for determining levan and dextran in raw juice by hydrolysing the precipitate (obtained by extraction with alcohol and centrifuging) with oxalic acid in three stages, in each of which hydrolysis is followed by centrifuging and then further acid hydrolysis. Results for juice from frosted and thawed beets showed a considerable increase in both polysaccharides during storage, with levan by far the more dominant one; there was no increase in either component during storage of undamaged healthy beets.

Sucrose crystallization kinetics applied to Quentin low-grade boiling. V. Maurandi and G. Mantovani. *Sucr. Belge,* 1980, **99,** 385-393. — See *I.S.J.,* 1981, **83,** 342.

Modernization of the energy economy in the sugar industry, with particular regard to processing technology. A. Zsigmond. *Cukoripar,* 1980, **33,** 61-65, 104-107 *(Hungarian).* — The energy requirements of the modern beet sugar factory are discussed and the need for reduction of fuel and power consumption is emphasized. How this can be done while maintaining optimum process conditions is described.

Waste water treatment in storage ponds equipped with fountains. H. Haucke. *Zuckerind.,* 1980, **105,** 986-991 *(German).* — Details are given of the system at Dinklar sugar factory in which water, used to transport filter cake and the mud from the Brukner treatment plant (which handles beet flume and wash water) to the mud settling ponds, is fed to storage ponds equipped with fountains. By comparison with conventional aeration equipment, the fountains have the advantages of smaller volumes of water to be moved and consequent reductions in energy consumption. Typically, 26,800 m^3 of waste water containing initially 2900 $mg.l^{-1}$ BOD_5 was treated over a 5-month period of fountain operation to give an effluent of 8 $mg.l^{-1}$ BOD_5. At a circulation period of 4 weeks and a water level of 1.85 m, energy consumption averaged 0.28 kWh per kg BOD_5.

Causes of centrifugal basket damage. Z. Tubl. *Listy Cukr.,* 1980, **96,** 252-258 *(Czech).* — Causes of centrifugal basket failure and its consequences are discussed. The reasons may lie in the use of unsuitable materials, poor construction, incorrect use of calculations or misuse of the centrifugal. While large-capacity baskets are designed for a service life of 10 years, in many cases they are suitable for use beyond this period; the potential life remaining in a basket can be established by means of a system of calculations described by the author. Since the extra service life also depends on the original calculations, the individual methods of calculation are compared.

The Gryllus effect. J. Ponant. *Cukoripar,* 1980, **33,** 133-135 *(Hungarian).* — See *I.S.J.,* 1981, **83,** 21.

Re-utilization of water in the flume circuit. L. Haraszti. *Cukoripar,* 1980, **33,** 145-149 *(Hungarian).* — Flume water treatment with various flocculants, including calcium hydroxide and aluminium sulphate, was tested. Soil removed from the beets during washing was also added as ballast and aided clarification. Comparison was made with untreated water in terms of COD and the suspended matter concentration after 30 minutes' settling. While the results indicated the possibility of recycling the treated water, further experiments are needed to establish optimum dosage rates.

Pumps solve difficult conveying problems in sugar factories. H. Bauerfeind. *Zuckerind.,* 1980, **105,** 1092-1096 *(German).* — A representative of Netzsch-Mohnopumpen GmbH describes the principle on which the Mohno pump operates and indicates its capability of handling difficult materials such as massecuite and undiluted carbonatation mud.

Sugar solution purification by electrochemical means. I. G. Bazhal, L. D. Bobrovnik, L. G. Vorona, M. P. Kupchik, L. A. Kupchik and Ya. F. Trachevskaya. *Sakhar. Prom.,* 1980, (12), 30-32 *(Russian).* — While electrodialysis removes salts of organic and inorganic acids as well as certain amino-acids, electrofiltration (in which the solution is passed through a column of granular material separated by ion exchange membranes from outer electrode chambers) removes colloids, colouring matter and high-M.W. substances. Experiments with a laboratory model were conducted on 2nd carbonatation juice, thick juice and molasses; the solutions were passed through a column of burnt clay granules and then via a pH adjuster back to the column, the process being repeated a number of times. In all cases there was a substantial reduction in the impurities content, and purity was increased by some 8 units for both juices. However, while 11 hours' treatment raised the purity of a molasses solution from 57.8 to 92.0, 3 hours' electrofiltration preceded by 3 hours' electrodialysis gave virtually the same results.

The drive of a continuous trough-type diffuser. J. Wawszczak. *Gaz. Cukr.,* 1980, **88,** 145-147 *(Polish).* Information is given on the modified Ward-Leonard drive as used for DDS-type inclined-trough diffusers. The main factors governing joint operation of two D.C. compound motors with armature windings in series and exciting windings in parallel are discussed. Problems of no-load operation and basic questions concerning loading of the system are examined, and basic disturbances that can occur and their consequences indicated.

Accidents in operation of belt conveyors. B. Karas. *Gaz. Cukr.,* 1980, **88,** 147-149 *(Polish).* — Six case histories are described in which personnel suffered injuries as a result of accidents involving belt conveyors Causes of the accidents and means of preventing them are indicated.

Manufacture of sulphur dioxide in a continuous burner. Z. Kalata. *Gaz. Cukr.,* 1980, **88,** 150-152 *(Polish).* A continuous sulphur burner designed by the author is described, and details are given of trials with a prototype having a maximum hourly output of 42.6 kg of liquid SO_2.

Identification of an evaporator. II. J. Radek. *Listy Cukr.,* 1980, **96,** 269-275 *(Czech).* — A continuous method of characterizing a linear regression model with a finite memory and its application to a 1st evaporator effect are described. The results obtained were found to be in close agreement with values obtained by solving the Wiener-Hopf integral equation for characterizing a system with more than one input but only one output.

LABORATORY STUDIES

Investigations on analytical determination of residues of plant protection chemicals in sugar factory products. I. Gas chromatographic method for determination of various active ingredients. E. Reinefeld, K. M. Bliesener and G. Urban. *Zuckerind.*, 1980, **105**, 900-906 *(German)*. Procedures for gas chromatographic qualitative determination of active ingredients of organo-chlorine and -phosphorus insecticides and a number of other pesticides and herbicides are described. Retention times, linear ranges of the detectors and limits of determination of the various ingredients are tabulated and some sample chromatograms reproduced.

Pulp dryer volatiles. II. Formation of volatile acids and carbonyl compounds in pulp drying. J. F. T. Oldfield, M. Shore, N. W. Broughton, C. W. Harvey and R. Parslow. *Sucr. Belge*, 1980, **99**, 339-347, 395-405. – See *I.S.J.*, 1980, **82**, 347.

Separation of monosaccharides by high-performance liquid chromatography: comparison of ultra-violet and refractive index detection. H. Binder. *J. Chromatogr.*, 1980, **189**, (3), 414-420; through *Anal. Abs.*, 1980, **39**, Abs. 5C24. – The separation of carbohydrates on a chemically bonded amino-substituted stationary phase, with 7:3 to 4:1 acetonitrile:water as mobile phase, is monitored by detection at 188 nm and by refractive index detection; calibration graphs are rectilinear over the range 10-600 μg of carbohydrate in the sample. The U.V. detector is more sensitive for rhamnose, arabinose, fructose and mannose, and (because it is less affected by pulsation of the pump than is the refractive index detector) has a lower limit of detection.

Separation of saccharides and their anomers by high-performance liquid chromatography. V. Kahle and K. Tesarik. *J. Chromatogr.*, 1980, **191**, 121-128; through *Anal. Abs.*, 1980, **39**, Abs. 5C25. – Studies were carried out on the effects of mobile-phase composition, temperature and sorbent surface area on the separation of sugars on aminopropyl-silica gel (prepared by treatment of 10 μm Silasorb with 3-aminopropyltriethoxysilane) in a stainless steel column (10 cm x 4 mm i.d.); flow rates of the acetonitrile:water mobile phases were 1-2 $ml.min^{-1}$ at < 2.5 MPa. For monosaccharides, the separation factors increased significantly as the water content was decreased, and there was a slight increase in efficiency at 30°C compared with 20°C, but above 40°C tailing occurred. A mixture of malto-oligosaccharides (from starch or maltose syrups) was separated in 12 min, with 3:2 acetonitrile:water as mobile phase, on a column of the aminopropylsilica gel (specific surface area 260 $m^2.g^{-1}$). Use of the same gel in the SO_4^{--} form made possible the separation of anomers, the relative amounts of each being estimated from the peak areas; this separation was more effective at 0°C than at 20°C for all the sugars tested except glucose.

Extraction and determination of free amino-acids and amides in sugar beet. J. Jarzebinski, B. Fitak, M. Gajewska, W. Drewnowska, H. Kozlowska and E. Walerianczyk. *Acta Aliment. Pol.*, 1979, **5**, (1), 15-20; through *Anal. Abs.*, 1980, **39**, Abs. 5G6. – Several methods of extraction of the free amino-acids and amides were examined. The extraction of free amino-acids was best carried out with 0.1N Li citrate buffer (pH 1.5), but extraction with water or by digestion with the buffer for 30 min at 75°C was satisfactory, provided that an appropriate correction factor was applied. The amino-acids (including asparagine and glutamine) and amides were separated and determined (with norleucine as internal standard) with an amino-acid liquid chromatograph (Jeolco Type JLC-6 AH) equipped with two columns of LCR-2 spherical sulphonated resin. Tryptophan and monobasic amino-acids were separated first, with a Na citrate buffer solution (pH 5.29) as mobile phase, then the neutral and dibasic amino-acids were separated by successive elutions with 0.25N, 0.3N and 0.3N Li citrate buffers (pH 2.78, 3.15 and 3.92, respectively); proline was determined by spectrophotometry at 440 nm and the other amino-acids at 570 nm. The overall time of analysis was 5.5 hr.

Investigation of changes occurring in sugar beet during storage. IV. Investigation of polyphenoloxidase activity. K. Hangyal and P. Meresz. *Cukoripar*, 1980, **33**, 95-100 *(Hungarian)*. – The importance of beet polyphenoloxidase (PPO) for sugar manufacture is explained, and the mechanism of its activity described. Determination of this activity involves a number of special problems, which are discussed. A brief description is given of a method, adapted for use with a Contiflo automatic analyser, based on measurement of the extinction of the conversion products of a pyrocatechin substrate. It is particularly recommended for routine analysis of beet samples.

The application of enzymatic analysis in the sugar factory. C. A. Accorsi and G. Vaccari. *Ind. Sacc. Ital.*, 1980, **73**, 93-102 *(Italian)*. – A survey is presented of enzymatic methods of analysis applied to beet, sugar and molasses, particularly for determination of amino-acids, amides, organic acids and mono-, di- and tri-saccharides.

Granulometry of sugar. C. H. Lopes. *Brasil Açuc.*, 1980, **96**, 42-51 *(Portuguese)*. – The AM-CV method of assessing sugar crystal granulometry is described and its limitations noted. The method was applied to samples of sugar exported from São Paulo state in the 1974/75 and 1975/76 seasons, and the results are tabulated. The method is recommended for chemical control.

Checking the currently valid ash factor for determination of white sugar conductimetric ash by determining the alkali and alkaline earth components using atomic absorption. G. Pollach and H. Berninger. *Zuckerind.*, 1980, **105**, 992-994 *(German)*. – The Kubadinow & Pollach flame atomic absorption method for determination of Na, K, Ca and Mg in white sugar[1] was used on 15 samples and the results (expressed as sulphated ash) compared with conductimetric ash values. This showed that where a mixed bed ion exchange procedure was used to prepare standard solutions, a conductimetric ash value averaging +1.00 ppm higher was obtained (the differences ranging from −3.7 to +5.0 ppm). Where aqueous standard solutions were used, the mean

[1] *Proc. 16th Session ICUMSA*, 1974, 223.

difference was +3.1 ppm, and where HCl was added it was +2.00 ppm. The mixed bed system proved valid for checking the determination of Pb and Cd in white sugar by the graphite tube technique.

The rate of carbon dioxide absorption under conditions of continuous 1st and 2nd carbonatation. III. The diffusion coefficient of carbon dioxide. E. Sarka. *Listy Cukr.*, 1980, **96**, 258-260 *(Czech)*. – The relationship between the diffusion coefficient for CO_2, D_{CO_2}, dynamic viscosity η and absolute temperature T is such that $(D_{CO_2}.\eta)/T$ = const. Values of the diffusion coefficient for CO_2 in water have been obtained from the literature and are tabulated, while values of the coefficient for CO_2 in sugar solution and of η for sugar solution of 13-20 pol have been calculated for temperatures of 20, 40, 60, 85 and 90°C.

Investigation of changes occurring in sugar beet during storage. V. Methodology of determining the activity of pectolytic enzymes in sugar beet. P. Meresz, K. Hangyal and R. Lasztity. *Cukoripar*, 1980, **33**, 135-138 *(Hungarian)*. – While pectins are important in maintaining the strength of cell walls and intercellular layers in the beet root, enzymes act on them by e.g. cleavage of the glycosidic links and depolymerization. Investigations have shown that the activity of these enzymes can be determined from the number of end-groups formed or by measuring the fall in viscosity of a pectin solution. The latter method was used to determine the action of a number of enzymes, and a linear relationship confirmed between enzyme activity and the changes in viscosity.

Application of high-performance liquid chromatography and enzymatic methods to food analysis with special reference to the determination of sugars. P. A. Jackson. *Anal. Proc.* (Roy. Soc. Chem.), 1980, **17**, 537-540. A brief survey is presented of HPLC techniques applicable to carbohydrate separation, with particular mention of the advantages of the system in which silica columns are coated with amine groups *in situ*[1]; these continually regenerate the stationary phase as it is pumped through the system and permit a high separation efficiency and greater long-term stability than shown by earlier columns. Calibration graphs for fructose, glucose, sucrose, lactose and maltose were found to be linear in the range 0.5-100 $g.l^{-1}$, while repeated injections of a standard solution of glucose gave a C.V. of approx. 2%. The technique is now used regularly in the Laboratory of the Government Chemist in the UK, and has been applied successfully to a number of analytical problems, including the detection of small quantities of invert sugar in sucrose. However, HPLC is insufficiently sensitive for certain applications, for which enzymatic techniques, being more sensitive, have had to be used. The major sugars determined enzymatically in the author's laboratory are glucose, fructose, sucrose and lactose; the methods used are those developed by Bergmeyer[2] based on dehydrogenases. Glucose and fructose are phosphorylated to their corresponding hexose-6-phosphate by ATP and hexokinase; the glucose-6-phosphate formed is then oxidized with dehydrogenase and NADP to give gluconate-6-phosphate and NADPH, the absorption of which is measured at 340 nm (the increase in absorption caused by the NADPH being proportional to the glucose content). The fructose-6-phosphate formed is converted to glucose-6-phosphate by addition of phosphoglucose isomerase, causing a rise in absorption which is proportional to the fructose content. Sucrose is determined by a series of reactions parallel to those for glucose after the sucrose has been hydrolysed by addition of invertase, the amount of glucose thus formed being proportional to the initial quantity of sucrose. Lactose is determined by adding β-galactosidase, which hydrolyses the sugar to glucose and galactose, the glucose then undergoing the same reaction as described above and causing a rise in absorption which is proportional to the lactose content. The enzymatic techniques do not permit quantitative scans of mixtures of sugars and are relatively expensive when purified enzymes are used; moreover, it is preferable to know which sugars are present before analysis is carried out. However, the lower limit of sensitivity is 5 $mg.l^{-1}$.

Studies on acid formation in and elimination from technical sugar juices. III. Occurrence and formation of formic acid in technical sugar juices. E. Reinefeld, K. M. Bliesener and U. Poltrock. *Zuckerind.*, 1980, **105**, 1079-1084 *(German)*. – Investigations are reported in which the enzymatic method of Reinefeld & Bliesener[3] was used to determine formic acid in model solutions. The acid, present in molasses at an average of 0.20% by weight, can, at higher concentrations, inhibit cell matter formation in yeast manufacture; it is formed by degradation of invert sugar and formalin in alkaline medium (hence, under liming conditions) and by raw juice fermentation (particularly under the effect of *Bacillus stearothermophilus* and *B. coagulans)*. During liming of 10% sucrose solutions which were then heated for 15 min to 85°C, addition of amino-acids slightly reduced formic acid formation, whereas injection of air more than doubled the quantity formed from degraded invert sugar. The amount formed from formalin was very much lower than that from invert sugar, which gave some 40% of the quantity found in molasses. The maximum formic acid concentration was found after approx. 45 minutes' reaction, after which it gradually fell.

Influence of sucrose content on absorption of CO_2 by aqueous solutions. R. Wasmund and H. Bultmann. *Zuckerind.*, 1980, **105**, 1085-1087 *(German)*. – In investigations on CO_2 absorption by model aqueous solutions of sucrose and citric acid, the presence of sucrose reduced absorption, and by an increasing amount as its concentration rose from 7.0 to 12.0% w/w. In all cases, CO_2 absorption rose with pressure in the range 1-9 bar and fell with temperature in the range 0-60°C.

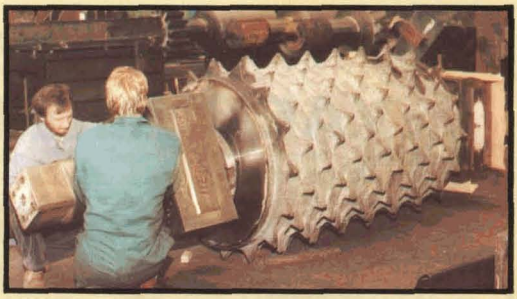
The application of chromatographic analysis in the sugar factory. G. Vaccari and C. A. Accorsi. *Ind. Sacc. Ital.*, 1980, **73**, 121-127, 130-133 *(Italian)*. – The literature on the application of paper, thin-layer, ion exchange, gas-liquid and liquid-liquid chromatography to chemical control in the sugar industry is surveyed with respect to the analysis of sugars and non-sugars including oxy-acids, amino-acids, etc., and with particular mention of application to liquid sugars, molasses and factory juices.

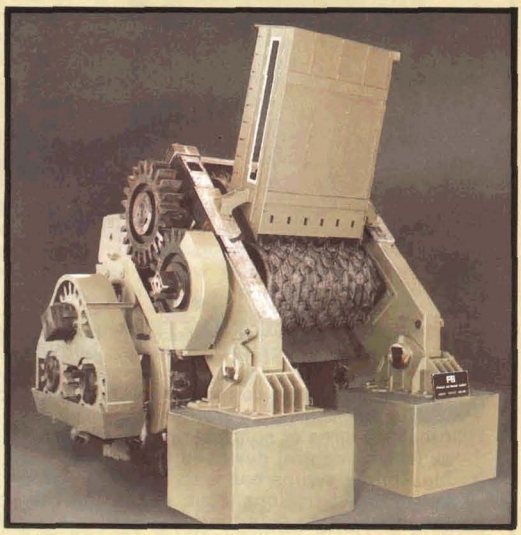
---

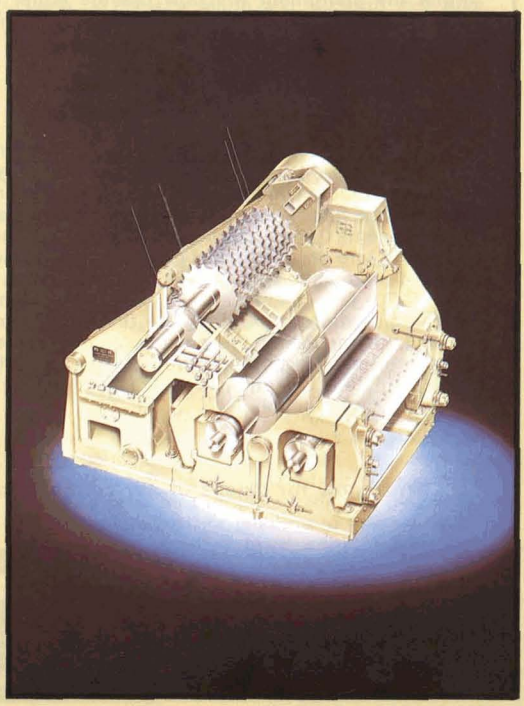
[1] Aitzetmüller: *J. Chromatogr.*, 1978, **156**, 254.
[2] "Methods of enzymatic analysis", 2nd Edn. (Academic Press, New York), 1974.
[3] *I.S.J.*, 1978, **80**, 378.

FS

PRESSURE FED MILL







The combination of the FS three roller mill with a toothed roller pressure feeder introduces a new dimension to the milling of cane, offering the opportunity to improve on the already high performances achieved by conventional FS three or four roller units.

The use of heavy duty pressure feeders was pioneered and patented by CSR in Australia during the 1930's and provided the basis for significant advances in mill efficiency. During the 1960's CSR developed the toothed pressure feeder to permit even better performance and equally to remove "sensitivity" from their operation thus allowing the mills to cope with wide ranges of feed preparation and rate of production. The system has been highly successful wherever installed and has overcome operating problems in mills in both Australia and Fiji. Since 1978 Fletcher and Stewart engineers in association with Polymex Pty (CSR's licencees) have been studying the applicability of the system to a wide range of operating conditions, resulting in designs which can be confidently offered for use throughout the world's sugar industry.

- **Greater Flexibility**
- **Higher Throughput Without Loss of Extraction Performance**
- **Improved Dewatering of Bagasse**
- **Lower Relative Power and Steam**
- **Reduced Maintenance**

A World of Experience

Fletcher and Stewart Limited
Derby DE2 8AB England
Telephone: (0332) 40261
Telex: 37514
Cables: Amarilla Derby Telex

BY-PRODUCTS

Fuel alcohol from sugar cane plants. M. Y. Lonkar. *Maharashtra Sugar,* 1980, **5,** (9), 135-139. – The manufacture of alcohol from cane molasses for use as fuel and for other purposes is described.

Ethanol from sugar cane: the EX-FERM concept. C. Rolz, C. de Cabrera and R. Garcia. *Maharashtra Sugar,* 1980, **5,** (9), 140-142. – See Rolz: *I.S.J.,* 1980, **82,** 47-51.

Improving conversion of molasses into alcohol and other related aspects. B. B. Paul. *Maharashtra Sugar,* 1980, **5,** (9), 143-150. – Continuous alcoholic fermentation of molasses is discussed, and a description given of a process in which steam consumption is minimized; other structural and design changes to fermentation equipment are suggested as a means of reducing the fermentation time and increasing fermenter capacity.

Molasses-based ethyl alcohol. V. K. Malik. *Maharashtra Sugar,* 1980, **5,** (9), 151-155. – Alcohol manufacture from cane molasses by continuous and batch fermentation processes is discussed.

Some interesting aspects of the chemistry of cane sugar. S. P. Phadnis. *Maharashtra Sugar,* 1980, **5,** (9), 157-159. Preparation of chloro-derivatives of sucrose as a means of producing alternative sweeteners of greater sweetness than sucrose is described.

Feed value of beet processing residues. G. Piva, E. Santi and M. Amerio. *Zootecnica Nutr. Animale,* 1979, **5,** 165-170; through *S.I.A.,* 1980, **42,** Abs. 80-1153. The possibility of absorbing concentrated vinasse on dried pulp is shown. The products obtained were analysed, and parameters of blood from ewes fed on them were measured. Vinasse from desalinated Quentin molasses was more suitable than that from ordinary molasses or untreated Quentin molasses. At the level of vinasse on dried pulp used (7.5% on dry solids) no problems were encountered; on the contrary, there was a beneficial effect on digestibility and on feed value.

Vinasse as raw material for biogas production. G. Filgueiras. *Saccharum* (STAB. São Paulo), 1979, **2,** (5), 12-15; through *S.I.A.,* 1980, **42,** Abs. 80-1160. Tables show past and projected (1967-87) annual consumptions of energy from various sources in Brazil and recent values for annual availability and fuel equivalent of agricultural by-products, including bagasse and vinasse. Schemes developed jointly by Eletrobras and Coperflu for simultaneous biogas generation and vinasse decontamination are outlined. Two-stage digestion of 1 m^3 vinasse by methane bacteria can generate 37 m^3 biogas (CH_4 + CO_2), equivalent to approx. 20 kg oil, with removal of 93% of the BOD and 65% of the COD. The possibility exists of fermenting bagasse to biogas rather than burning it, and thus producing extra organic fertilizer.

Single-cell protein production by *Trichoderma longibrachiatum* on treated sugar cane bagasse. M. S. Sidhu and D. K. Sandhu. *Biotech. Bioeng.,* 1980, **22,** (3), 689-692; through *S.I.A.,* 1980, **42,** Abs. 80-1187. The above organism was cultured in media containing powdered bagasse, which was either untreated or delignified by treatment with a solution of sodium chlorite + acetic acid at 70-80°C for 4 hr, with or without subsequent treatment with NaOH. Best results were obtained by 144 hr culture using bagasse treated with chlorite but not NaOH; this gave 27% protein in biomass and a conversion efficiency (protein produced/substrate utilized) of 0.22. There was no clear relationship between activities of individual enzymes and biomass production or substrate utilization.

Glycerine in alcoholic fermentation of molasses and cane juices. A. Parfait and C. Jouret. *Ind. Alim. Agric.,* 1980, **97,** 721-724 *(French).* – The effects of a number of parameters (production method, pH, seeding rate, sugar content and yeast type) on the quantity of glycerine present in rum were investigated. While cane juice or molasses used as raw material contain few microorganisms, even after storage, so that the glycerine content is very low, anaerobic fermentation in the presence of *Schizosaccharomyces* sp. causes formation of large quantities of glycerine, which may create the risk of contamination by glycerine-degrading bacteria. Glycerine metabolism by lactic bacteria such as *Leuconostoc mesenteroides* leads particularly to formation of acrolein and allyl alcohol, which spoil the taste of rum.

Energy economies in pulp and lucerne dehydration by low-temperature drying (patented predrying process). –.Lucas, –.Lucas, –.Morin and –.Ledru. *Ind. Alim. Agric.,* 1980, **97,** 739-742 *(French).* – The predrying system described is installed between the conveyor feeding the material (e.g. beet pulp) to the drum dryer and the dryer itself. It comprises one or more perforated endless belts on which the material is heated with air at about 60°C which is blown through a glass tube heat exchanger; some of this air is fresh and the remainder recycled flue gas from the drum dryer. The recycled gas is passed through a washer to reduce fouling of the exchanger and improve its heat output. A heat saving of 33% has been accomplished with a predrying unit installed in 1978 at a French sugar factory by comparison with the previous conventional system, although an increase in electricity consumption of about 20 Wh per kg water evaporated must be taken into account.

The use of sugar beet by-products in stock breeding. A. Giouzelgianne. *Hellenic Sugar Ind. Quarterly Bull.,* 1980, (42), 205-225 *(Greek).* – The value of beet pulp, leaves and molasses as animal fodder is discussed, and their greater use in Greece advocated. They have been used as feedstuffs on only a very limited scale, farmers showing a preference for more traditional fodders such as hay and straw. Major problems to overcome in instituting a feed program based on beet by-products are examined.

The sugar factory/distillery and new forms of energy. P. Devos. *Ind. Alim. Agric.,* 1980, **97,** 751-754 *(French).* Vinasse from a beet sugar factory/distillery can be treated to yield fertilizer, while the yeast fraction can be

recovered and added to beet pulp before drying so as to give a protein-rich feedstuff. It is calculated that fermentation of 25% of the pulp from a sugar factory, of the vinasse from the distillery and of the biodegradable material in the waste waters would yield sufficient alcohol to cover the energy needs of the distillery section. Mention is also made of the production of methanol from CO_2 (liberated during fermentation) and hydrogen.

Rum distillery wastes: potential agricultural and industrial uses in Puerto Rico. G. Samuels. *Sugar J.,* 1980, **43,** (4), 9-12. – The Puerto Rican rum industry has some 200 million gallons of vinasse to dispose of each year, and the Environmental Protection Agency has ruled that dumping in coastal water, as practised at present, must stop by 1983 unless the vinasse is adequately pretreated. The composition, source and quantity of vinasse at a rum distillery are described, and information given on potential uses of vinasse, including its application as fertilizer of high K content, as a source of methane gas for use as a fuel, as a source of animal fodder, and a number of lesser known applications.

Kinetic considerations and diluting factor for alcoholic fermentation of beet molasses. F. Parisi, M. del Borghi and G. Ferraiolo. *Alkoholi Teollisuus Tutkimus,* 1977, 163-169; through *S.I.A.,* 1980, **42,** Abs. 80-1337. Rates of ethanol and yeast production and sugar consumption were measured during the fermentation of glucose, sucrose and molasses by *Saccharomyces cerevisiae* var. *eridania.* In defined media of low salt content, sucrose was fermented as rapidly as glucose. Fermentation was slower with molasses, or with sucrose + salts in concentrations approx. equal to those in molasses. Fermentation was accelerated by treatment of the molasses with an anion exchange resin in Cl^- form to remove high-molecular weight colorants. In all four sucrose-containing media, the maximum rate of yeast growth was reached just before the maximum rate of ethanol production, towards the end of fermentation. The ratios of the rates at any instant were such that the kinetics of each fermentation could be predicted from that of any other. It is suggested that the lower fermentation rate of molasses was due to both the higher osmotic pressure and the presence of high-molecular weight colorants. In this medium, maximum ethanol production was obtained with a dilution ratio of 0.0578 hr^{-1}.

Lactic acid production from molasses by mixed population of *Lactobacillus bulgaricus* **and** *L. delbrueckii.* K. P. Tiwari, A. Pandey and N. Mishra. *Proc. Nat. Acad. Sci. India,* 1977, **47** (A), (2), 130-132; through *S.I.A.,* 1980, **42,** Abs. 80-1340. – When a mixture of the above organisms was cultured under stated conditions in a solution of 540 g molasses in 1 litre of water, the lactic acid yield was 3.26 g/100 ml, equivalent to 78% on total sugars, compared with 44% and 62% by the respective organisms separately.

Preparation and characterization of dextran from molasses by the action of a locally isolated strain of *Leuconostoc mesenteroides.* S. A. H. Zaidi, J. Jafri and R. Zuberi. *Pak. J. Sci. Ind. Res.,* 1977, **20,** (6), 402-404; through *S.I.A.,* 1980, **42,** Abs. 80-1383. – Dextran was produced by culturing a strain of *L. mesenteroides* in a medium containing 250 g cane molasses per litre. Filtration of the molasses was the only pretreatment necessary. The crude dextran was purified by treatment with HCl:95% ethanol (1:1), which decreased the ash content from approx. 15% to 1.2-1.5%; the product (approx. 12% on molasses) contained 81.5% dextran and 9.0% reducing sugars, and was suitable for industrial use.

Ensilage of enriched, pressed pulp and its utilization for fattening. J. P. Vandergeten and R. Vanstallen. *Publ. Trimest. Inst. Belge Amél. Betterave,* 1980, **48,** 73-94 *(French, Dutch).* – Beet pulp enriched with molasses, urea, minerals, trace elements and vitamins was ensilaged and finally fed *ad libitum* to two groups of bulls over a period of 70 and 103 days. During ensilage, the additives did not percolate to the lower part of the stored material, there was no odour, losses were very low (< 2%), while the lactic acid content was high at 5.54% on dry matter. The bulls, fed only on the 25% dry matter silage plus 1 kg of straw per day, increased weight at a daily rate of 1.47 kg, which is considered an excellent result.

Ethanol from sugar beet – a new production objective? D. M. Dambroth. *Die Zuckerrübe,* 1980, **29,** (6), 13-15 *(German).* – The advantages of the sugar beet as a source of ethanol for use as fuel or chemical feedstock are indicated and the feasibility of large-scale production based on it is discussed.

How to evaluate pressed pulp silage as cattle fodder. E. Pfeffer. *Die Zuckerrübe,* 1980, **29,** (6), 22-23 *(German).* –The composition of wet pulp, dry pulp and pressed pulp silage is indicated, and aspects of silage production and feeding of it to cattle are discussed.

Effect of alcohols and related compounds on the production of citric acid by *Aspergillus niger* **from beet molasses.** F. A. Hamissa. *Chem. Mikrobiol. Technolog. Lebensmittel,* 1978, (5), 157-160; through *S.I.A.,* 1980, **42,** Abs. 80-1473. – When the above fermentation was carried out by the surface technique, addition of 2% of methanol or ethanol to the medium considerably improved the yield of citric acid; 2% of ethyl acetate or chloroform had no significant effect, and 2% of propanol or 0.3% of formaldehyde prevented growth of the organism. When the submerged technique was used, methanol and ethanol caused a smaller increase in yield, ethyl acetate had almost no effect and the other three compounds prevented growth. The optimal time of addition of alcohols was at the start of incubation, except that, when the surface technique was used and methanol was added, 24 hr after the start was preferable.

Kinetic model for the prehydrolysis of sugar cane bagasse with concentrated sulphuric acid. R. López Planes. *Cellulose Chem. Technol.* (Rumania), 1978, **12,** (3), 355-362; through *S.I.A.,* 1980, **42,** Abs. 80-1495. – On the assumption that two types of bagasse pentosan exist and that oligosaccharides are formed as intermediates, a kinetic model is derived to describe bagasse hydrolysis by 16-66% H_2SO_4 at 40-80°C. Data on pentosan degradation, pentose formation and reducing sugars formation are graphed and kinetic parameters are tabulated. In the early stages of reaction, oligosaccharides constitute the major part of the reducing substances; the content of reducing monomers can be estimated using the total hemicellulose decomposition constant in the early stages and the pentose formation constant in the later stages.

BREVITIES

Mozambique sugar prospects[1]. – In 1973 Mozambique produced nearly 400,000 tonnes of sugar; five years later output was half this level. The four state sugar factories lost virtually all their expatriate staff in the days after independence in 1975. At the same time, the new mill at Marromeu (formerly owned by the British Sena Sugar Estates Ltd. but now managed by the Cubans) had its expansion schedule totally disrupted, with cane output subsequently depressed by guerrilla activity in the area. The downturn in output has not been parallelled by a fall in consumption; this has advanced from an estimated 130,000 tonnes in 1976 to a level approaching 175,000 tonnes and, as a result, the quantity available for export has slumped from 250,000 tonnes before independence to little more than 50,000 tonnes at present. There seems little doubt that the mid-1980's will see consumption exceed 200,000 tonnes; indeed, it is probable that the 250,000 tonnes mark will be passed before the end of the decade. These estimates assume too that, as far as it is able, the government will discourage demand in order to maximize exports. Between 1977/78 and 1980/81 output advanced from 200,000 to 225,000 tonnes. A £15 million spare parts contract has recently been signed with Tate & Lyle, however, and it would seem not unreasonable to expect short term improvements in productivity to raise annual output to around 300,000 tonnes by 1985. By that time, Marromeu's problem should have been rectified so that it would be able to achieve full production (110,000 tonnes/year) in the second half of the decade. With improvements to other facilities this could permit attainment of over 400,000 tonnes by 1990. On a conservative basis of 275,000 tonnes output in 1985 and 400,000 tonnes in 1990, export availability would rise from around 75,000 tonnes in 1985 to 150,000 tonnes in 1990.

US sugar exports increase[2]. – Sugar exports from the US totalled 586,000 short tons in the first seven months of 1981 and may have reached a million tons in the whole year, against a total of 650,000 tons in 1980. Refined sugar accounts for nearly 96% of the 1980 total, the remainder being almost wholly raw sugar. Exports remained high in 1981 because US refiners were receiving substantial drawback (Government repayment of sugar import duties and fees) for claims made within three years of the period in which a corresponding quantity of sugar was imported into the USA. This means that, with drawback payments of over 6 cents/lb in some instances, US refined sugar exports have become competitive in the world market, despite recent declines in world prices. Unless the 3-year eligibility period is extended, little or no significant drawback for sugar exports will be reclaimable after October 1982 because import fees dropped to zero in October 1979, and the then duty of 2.8125 cents/lb was reduced to the minimum of 0.625 cents/lb from February 1, 1980.

New Barbados sugar factory[3]. – The Caribbean Development Bank and Barbados Sugar Factories Ltd. have signed a $3,000,000 loan agreement to help build the new Portvale sugar factory. The factory, expected to be ready for the 1982 harvest, is to replace two obsolete plants which were closed after the 1981 crop. The new factory will have a crushing capacity of 140 tonnes of cane per hour.

Zimbabwe mill record. – When the mills stopped crushing on December 17, 1981, a total of 2,022,898 tonnes of cane had passed through the Chiredzi factory of Hippo Valley Estates Ltd. and the record crush produced a record outturn of 251,331 tonnes of raw sugar, compared with 210,681 tonnes in 1980, making the factory the biggest producer in Africa during the season. The performance was made even more significant by the fact that this sugar tonnage was achieved at the highest overall recovery (87.98%) and the highest overall time efficiency (88.64%) recorded in Africa in 1981. As a result of steadily improving circumstances on the national railways it is likely that the greater part of the sugar stockpile will be transported to Maputo for shipment before the start of the 1982 milling season in April or May.

Indonesia sugar expansion[4]. – Indonesia, which imported a record of more than 700,000 tonnes of sugar in 1981, hopes to be self-sufficient in sugar after 1983, with the construction of new mills and rehabilitation of old ones. 18 new factories are to be built outside Java by 1983 at a total cost estimated at $1800 million. Besides building the new factories and opening up new cane plantations, Indonesia is also rehabilitating at least 27 of its old sugar factories in Java, the traditional sugar producing island, and this is expected to increase milling capacity by 21% in 1983 from a current 87,700 tonnes per day.

Weightech '83. – This is the name of an exhibition of industrial and process weighing and force measurement equipment and systems, to be held during September 13–15, 1983 at the Wembley Centre, London. It is to be organized by the Institute of Measurement and Control, 20 Peel Street, London W8 7PD, England, and follows a highly successful Weightech '81 exhibition last year. The Institute is calling for papers to be presented at an associated conference, and sessions are planned on a range of subjects covering recent research and development in weighing and force measurement and the design and application of industrial and process weighing systems, etc.

Western Australia cane and sugar yield[5]. – A full assessment of the 80-hectare pilot cane farm under plant, first, second and third ratoon crops will be possible in the 1981/82 season, according to a Western Australia Government summary of a report by the Ord River research station. A sugar yield of 33.2 tonnes.ha^{-1} has been attained with Q80 cane and is thought to be an Australian, if not a world, record for a crop with the same growing period under commercial conditions. There has been a significant similarity between cane and sugar yields achieved in the 25 ha of experimental cane and on the 80 ha pilot farm. It is considered that, with good management, it should be possible for the Ord River area to average commercially 150 tonnes of cane per ha over a plant and three ratoon crops, with a c.c.s. of between 14 and 15. The resulting sugar yield of more than 20 tonnes.ha^{-1} compares favourably with the best area in Queensland (the Burdekin), which achieves a commercial yield of 18 tonnes of sugar per ha.

Yugoslavia sugar expansion[6]. – The beet area in Yugoslavia is to be increased this year to 180,000 hectares against the 145,000 ha in 1981. In the latest campaign a beet crop of 6.0 million tonnes was expected and the target for 1982 is 7.7 million tonnes. It is hoped that this will yield 1 million tonnes of sugar, of which some 150,000 tonnes will be for export.

Continuous alcohol fermentation process[7]. – A new low-cost continuous process has been developed jointly by Takara Shuzo Co. of Kyoto and Kansai Chemical Engineering Co. of Amagasaki, both in Japan. The yeast employed is fixed in alginic acid capsules only 1–3 mm across and held in a three-stage conical fermentation tower to which a feed of raw cane juice or molasses is applied. The process has been patented and pilot plant trials in 1981 were to be used to gather sufficient data for commercialization.

New Egytian sugar factories[8]. – The beet sugar factory in Barari (in the north of the Nile Delta), which came on stream in July 1981, is to reach an annual production of 100,000 tonnes. The 1981 beet area was reported to have amounted to 4200 hectares, from which a sugar production of 16,000 tonnes was expected. Some 21,000 hectares which was so far no usable owing to the excessive salt content of the soil is to be improved and sown to beets. In view of the first results, the Egyptian government envisages the construction of three new factories. A cane sugar factory is to be built at Khayah with a production amounting to 150 tonnes of sugar per day. Furthermore, a fructose factory is to begin trial operation in 1982, the liquid product to be used mainly for the production of confectionery and for the sweetening of beverages.

US sugar factory closures. – The Meeker and Smithfield cane sugar factories in Louisiana were closed before the start of the 1981 season, while the Holly Sugar Corporation has announced[9] that its Hamilton City beet sugar factory in California is to be closed after the 1981/82 campaign, owing to an insufficient supply of beets.

---

1 F. O. Licht, *International Sugar Rpt.*, 1981, **113**, 689-690.
2 *USDA Sugar & Sweetener Outlook & Situation*, Sept. 1981, 15.
3 F. O. Licht, *International Sugar Rpt.*, 1981, **113**, 730.
4 *Westway Newsletter*, October 1981, 11.
5 *Australian Canegrower*, 1981, **3**, (9), 10.
6 F. O. Licht, *International Sugar Rpt.*, 1981, **113**, 706.
7 *World Sugar J.*, 1981, **4**, (5), 34.
8 F. O. Licht, *International Sugar Rpt.*, 1981, **113**, 712.
9 *World Sugar J.*, 1981, **4**, (5), 39.

International Commission for Uniform Methods of Sugar Analysis 18th Session, 1982

The International Commission for Uniform Methods of Sugar Analysis will hold its 18th Session in Ireland during June 13-18, 1982. The venue for the Session will be Jury's Conference Centre, Ballsbridge, Dublin.

A limited amount of reserved accommodation is available at conference rates at the following hotels: (a) Jury's International Hotel, (b) Burlington Hotel, and (c) Mount Herbert Hotel. Travel arrangements and/or hotel reservations may be made through Mr. Ray Creighton, Panorama World Travel Ltd., 93 Morehampton Road, Dublin 4 (*Telephone:* 685599, *Telex* 31098 ETA EI) or through Miss Mary O'Sullivan, Chairwoman of the Irish National Committee of ICUMSA, Irish Sugar Co. Ltd., St. Stephen's Green House, Dublin 2, Ireland.

Jamaica sugar factory closure[1]. – The Jamaican Minister of Agriculture has announced that its sugar workers' cooperative and a sugar factory are to be closed and its sugar agencies restructured to revive the ailing industry. The cooperative, begun in 1976, had commendable objectives but is now bankrupt and unable to pay any bills. The cooperative's workers are to be given BWI $2,750,000 in severance pay and $206,000 in interest as well as retaining $56,000 equity in Monymusk Land Company, the holding company for state-owned sugar lands. The lands will be leased out and the Holland sugar factory in St. Elizabeth will close. The three government-owned sugar factories will lease the lands and take over all equipment and management functions. The Sugar Industry Authority and the National Sugar Company will undergo administrative changes to make them more efficient, and will work on a program to increase sugar production by improving harvesting programs and irrigation.

West Indies Sugar Technologists 1982 meeting. – The 1982 meeting of the West Indies Sugar Technologists will be held during June 14-18, the venue being the Fort Thomas Hotel, St. Kitts. The program will include presentation of technical papers and tours to observe aspects of agricultural activities in St. Kitts. Intending participants should write to Mr. L. A. James, National Agricultural Corporation, P.O. Box 399, Basseterre, St. Kitts, West Indies, no later than March 31, 1982.

UK solids handling exhibition. – Solidex 82, the second solids handling exhibition and conference, is to be held in Harrogate, England, during March 30-April 1, 1982 and will include stands for the exhibition of equipment for mechanical and pneumatic conveying, silo and IBC storage, valves, level controls, weighing and discharge aids, dust control, blowers, sack filling and emptying. Current exhibitors number 145. The concurrent conference on "Modern Technology in Bulk Solids Handling" will be held over five half-day sessions, covering Mechanical handling; Health and safety; Pneumatic conveying; Inter-plant transport and storage; and Weighing technology and flow control, each of which can be attended separately. Free tickets to the exhibition are available from Trinity Publishing Ltd., Station Approach, Long Lane, Hillingdon, Uxbridge, Middlesex, England UB10 9NR, who can also provide further information on the conference, for which the total fee is £110 plus 15% V.A.T., which includes a ticket to the conference dinner.

Sugar project in Sri Lanka. – The Government of Sri Lanka has announced its support for the newly formed Pelwatte Sugar Company Ltd. (PSC) which will establish a major rainfed sugar project in the Moneragala district of south-eastern Sri Lanka. The feasibility study and detailed planning for the project have been undertaken by Booker Agriculture International, who will be corporate managers of PSC. Pelwatte is the biggest project ever undertaken jointly by the private sector and government in Sri Lanka. Initially, Pelwatte will be designed to produce about 47,000 tonnes of sugar per annum, which is over 20% of Sri Lanka's consumption, with provision to expand to 70,000 tonnes per annum in the future. About half of the cane will be supplied by 2100 settlers who will be allocated 4-acre cane plots, the balance coming from Pelwatte's nucleus estate. About 10,000 jobs will be directly created by the project. The total project cost is estimated at about £33m in 1980 terms. The Sri Lankan Government has undertaken to provide 25% of the equity or 10% of the total cost, whichever is the less. The majority of the funding will come from institutional investors outside Sri Lanka.

Costa Rica fuel alcohol projects[2]. – U.S. Alcohol Corporation has announced that it is to build two alcohol distilleries in Costa Rica. The project is valued at $36 million and will create a 50 million litres annual production capacity. The plants, to be completed by 1983, are part of a Costa Rican plan to convert to total alcohol fuel use by 1992. They will produce 200-proof alcohol for mixing with gasoline during a three-year transition period, then switch to 190-proof alcohol for use as fuel unmixed with gasoline. Sugar cane for use as raw material will be grown on currently under-utilized land.

Colombia sugar problems[3]. – An aid program for Colombia's sugar industry has been promised by the government, involving measures to defend export and domestic prices and to stimulate production. According to the calculations of Asocana, the body grouping the major sugar producers and cane growers, raw sugar production in 1981 was expected to be 70,000 tonnes less than the record 1,250,000 tonnes made in 1980. Exports were expected, however, to decline even more sharply, at 160,000 tonnes compared with 293,000 tonnes in 1980. Colombia had already declared a shortfall of 102,238 tonnes against its ISA export quota for 1981 of 277,261 tonnes. The crisis for the Colombian industry was said to be the result of low world sugar prices, protectionist policies adopted by industrialized nations and internal production problems; dry weather throughout 1980 and the first quarter of 1981 had damaged the cane and reduced its sugar content. A major factor behind the reduction of sugar available for export, however, has been the very sharp increase in domestic offtake; in 1980, Colombian consumption of sugar, at 992,378 tonnes, raw value, was up 18.44% on 1979 consumption of 837,902 tonnes and official estimates indicated a further rise in 1981 of nearly 7% to 1.06 million tonnes while local sources believe the final figure could be well above this.

Pakistan sugar factory for Bangladesh[4]. – Pakistan has finalized a contract for the sale of a sugar factory to Bangladesh for $7,500,000. The plant, which is to come into operation in about 18 months, will have a daily crushing capacity of 1500 tonnes of cane. At present Bangladesh has 15 sugar factories with crushing capacities between 200 and 1500 t.c.d.; production in 1980/81 was 155,000 tonnes while domestic consumption was estimated at 180,000 tonnes, necessitating imports to cover the shortfall.

Zambia ethanol project[5]. – The International Finance Corporation is considering investing in the ethanol project at Nakambala Sugar Estate in Mazabuka. This is to be a joint project with Zambia Sugar Co. Ltd., a company in which Tate & Lyle of the UK and the Industrial Development Corporation of Zambia are shareholders.

Indian bagasse paper project[6]. – A $100 million loan from the World Bank will be used for the construction of a paper factory in Tamil Nadu State in India. The plant will produce 100,000 tonnes of newsprint or 80,000 tonnes of printing paper or a combination of both, using bagasse as the main raw material.

Italian 1981 campaign results[7]. – In the 1981 campaign, 17,315,000 tonnes of beets were sliced, against 13,250,000 in 1980. The sugar content varied from 13.35% in the north of the country to 14.68% in southern Italy and 15.06% in the centre, giving a national average of 13.76%. Total sugar production in 1981 reached 2,033,700 tonnes, against 1,777,320 tonnes in the previous campaign.

PERSONAL NOTES

Mr. N. R. Khariawala has been appointed Director of the National Sugar Institute, Kanpur, India, in succession to **Dr. N. A. Ramaiah** who has retired.

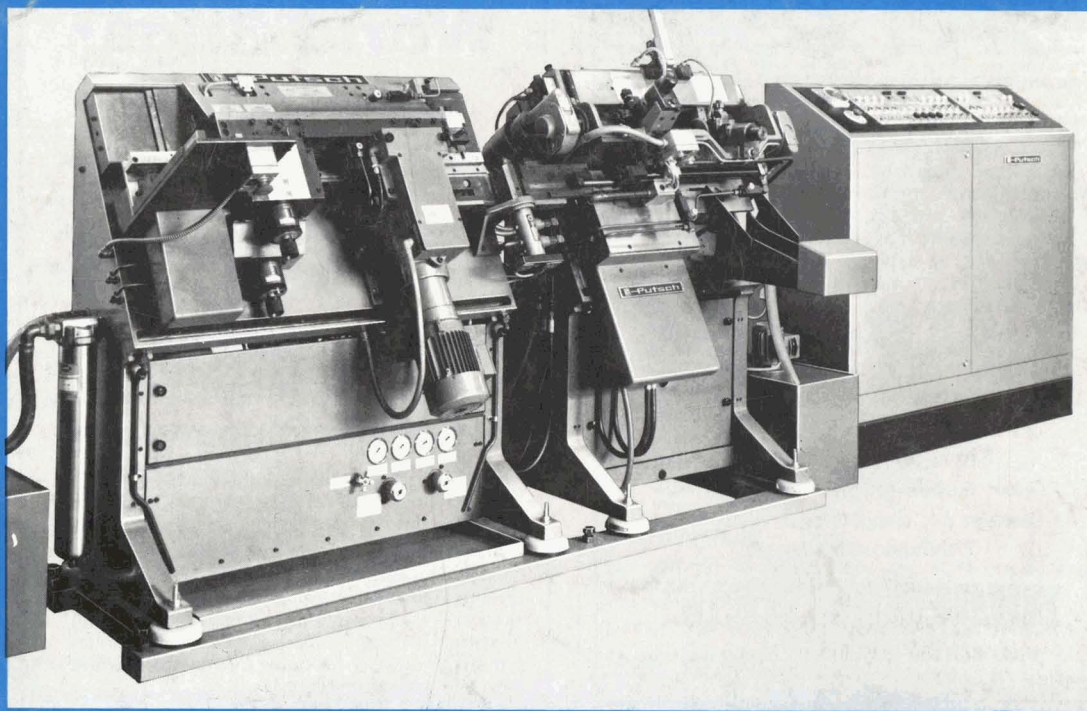
We regret to report the death of **Mr. J. H. Nicklin**, former Chief Technologist (Engineering) of the Bureau of Sugar Experiment Stations. After working as an electrical engineer for a number of organizations, including Amalgamated Sugar Mills Ltd., he joined the Bureau in 1945 and was promoted to Chief Technologist in 1951, serving in that capacity until he retired in 1969. He was well known for his contributions on electrical planning in sugar factories and on steam usage and economy.

---

[1] F. O. Licht, *International Sugar Rpt.*, 1981, **113**, 752.
[2] *Westway Newsletter,* 1981, (97), 13.
[3] *World Sugar J.,* 1981, **4**, (6), 39-40.
[4] F. O. Licht, *International Sugar Rpt.*, 1982, **114**, 18.
[5] *Standard Chartered Review,* December 1981, 3.
[6] *Westway Newsletter,* 1981, (97), 14.
[7] *Zuckerind.*, 1981, **106**, 1142.

Index to Advertisers

Performance proves Putsch Quality



Now Complete Automation:

Putsch

has added the new Fully Automatic Straightening and Dressing Machine RBA 75 to the Beet Knife Sharpener MSA 75. Koenigsfeld Knives are automatically transferred between the two machines.

The Thoroughbred in Beet Knife Sharpening offers you increased precision and less labour costs.

Please ask for our offer and literature.

Putsch

H. Putsch & Comp. Postfach 4221 · 58 Hagen 1 /W. Germany
Telefon (02331) 31031 · Telegramme: Putsch Hagen · Telex: 823795

In the USA: H. Putsch & Company, Inc. P. O. Box 5128 · Asheville, N. C. 28803
Telephone (704) 684-0671 · Telegram: Putsch Avl · Telex: 577443