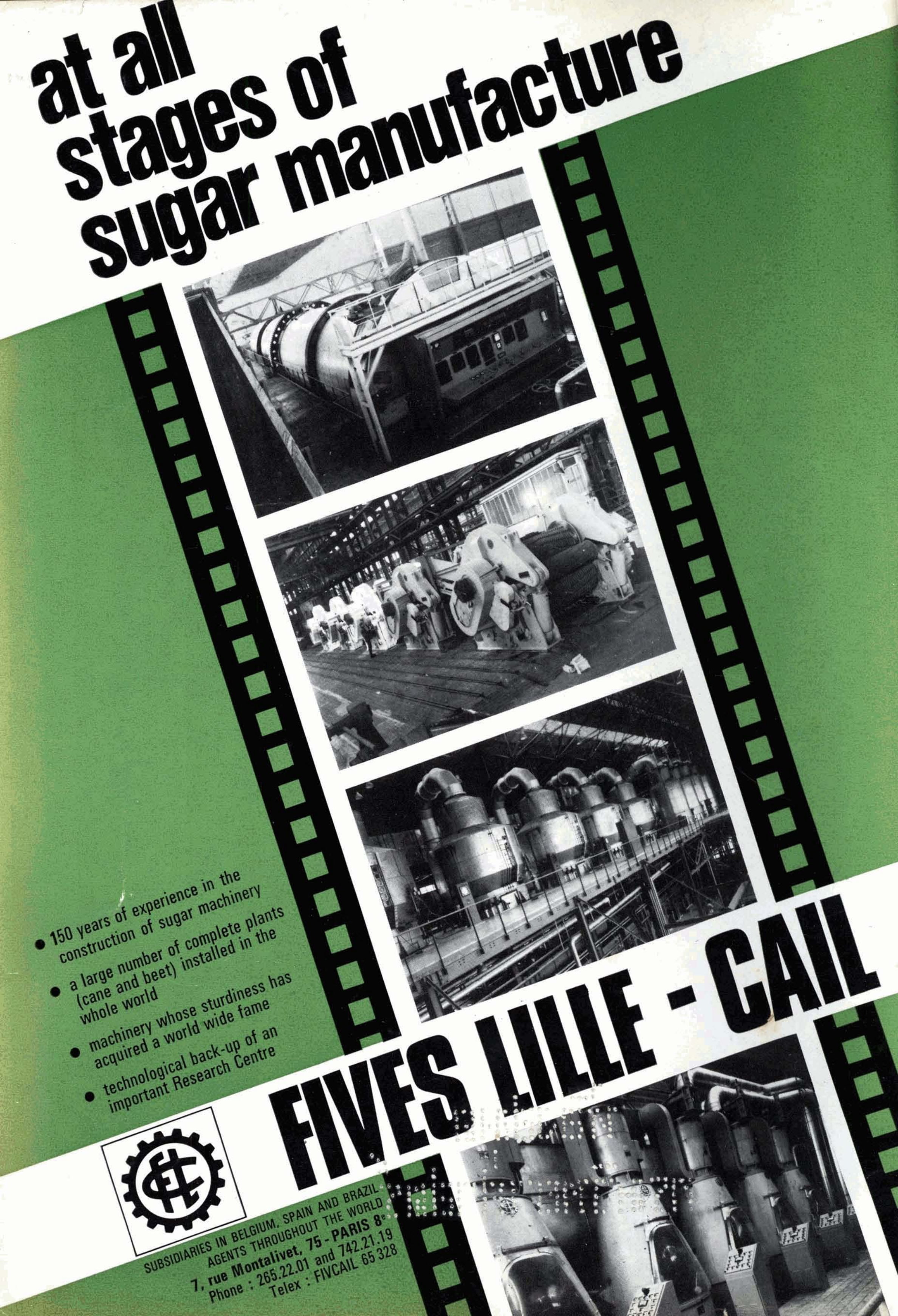
THE **International Sugar Journal**

JUNE 1972



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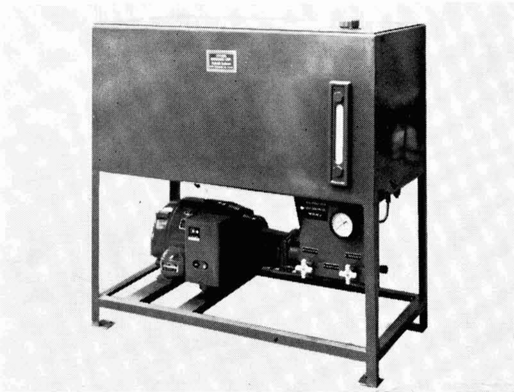

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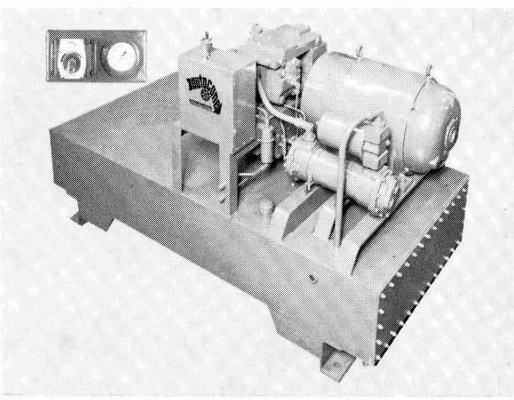

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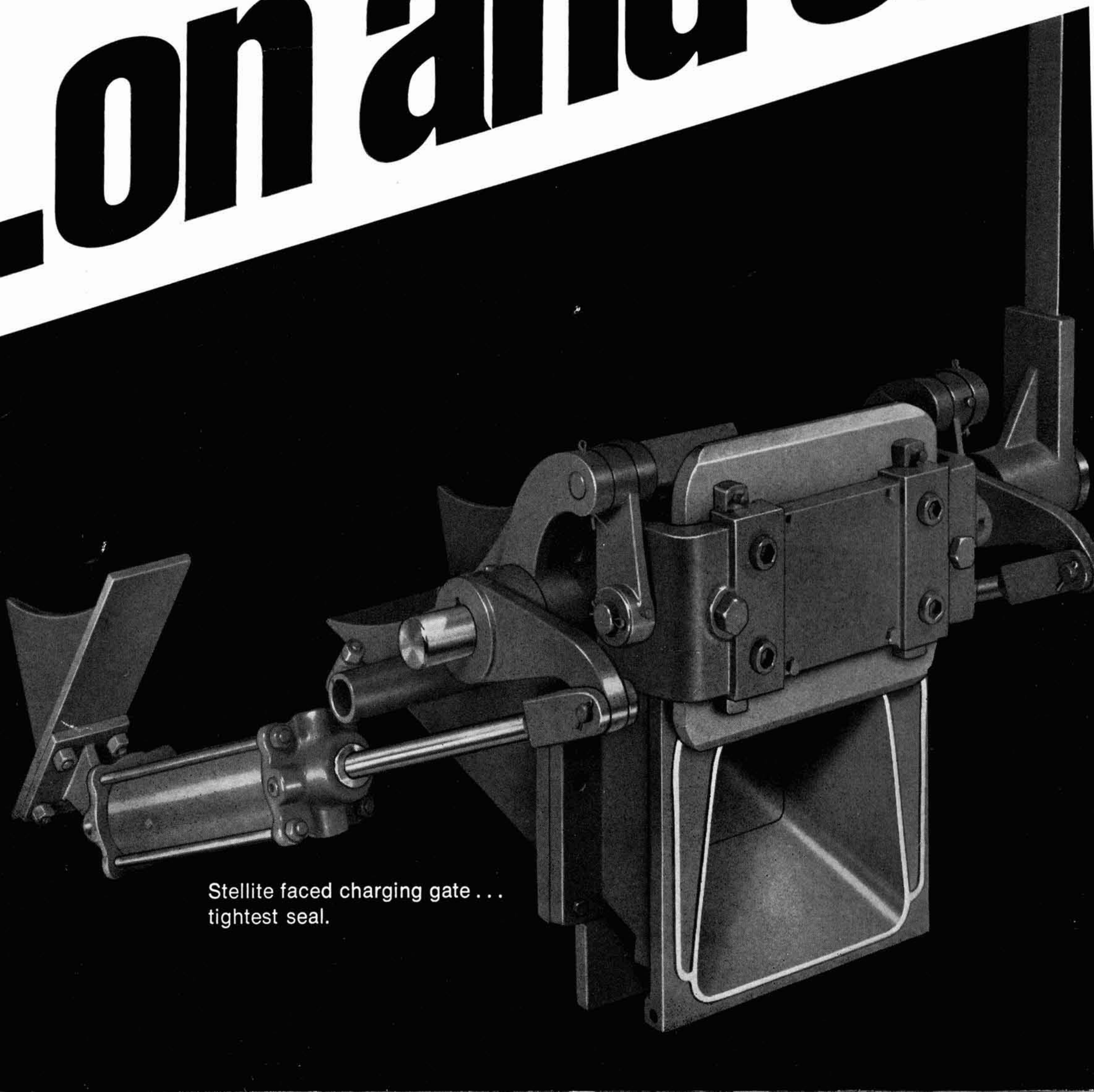

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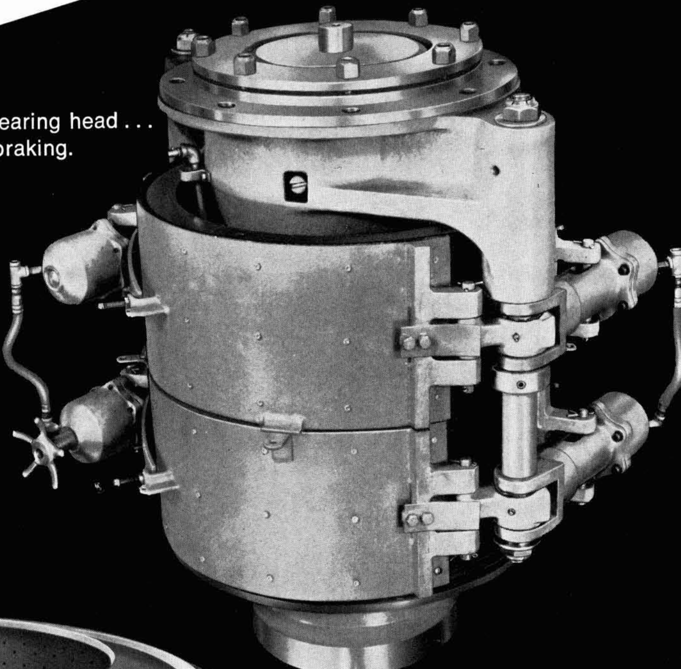

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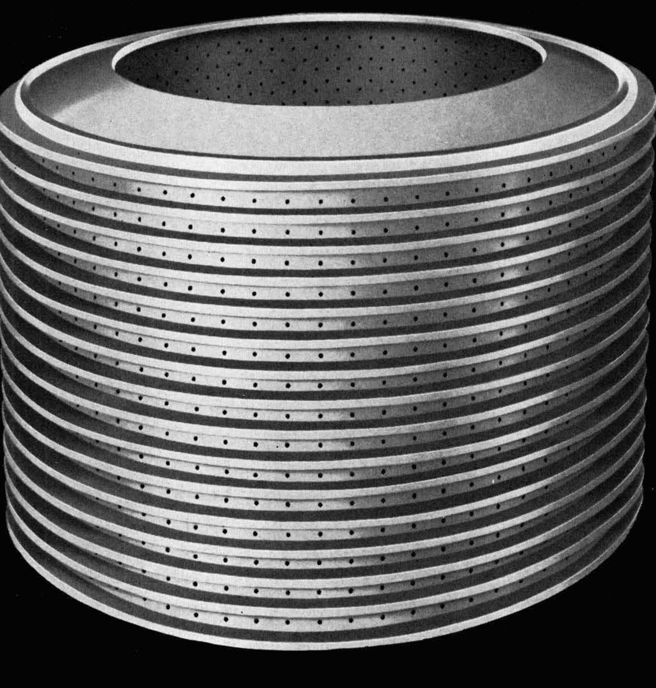

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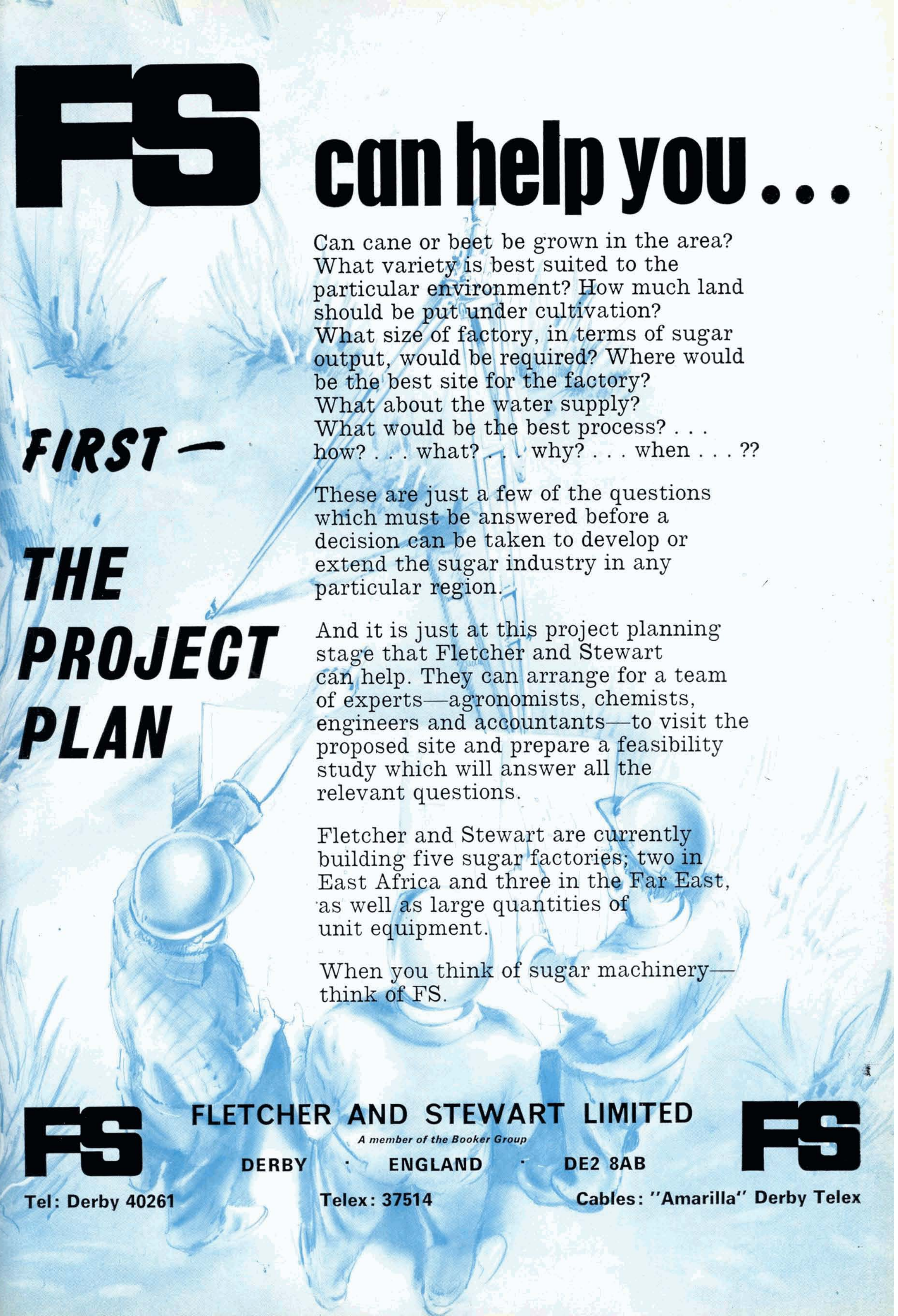
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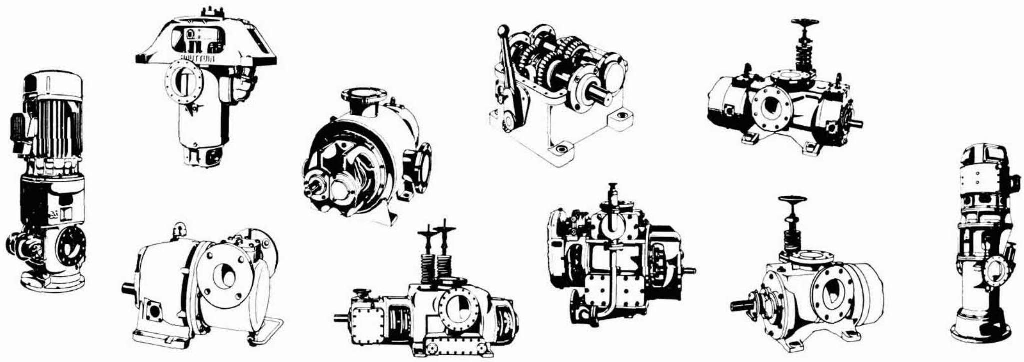

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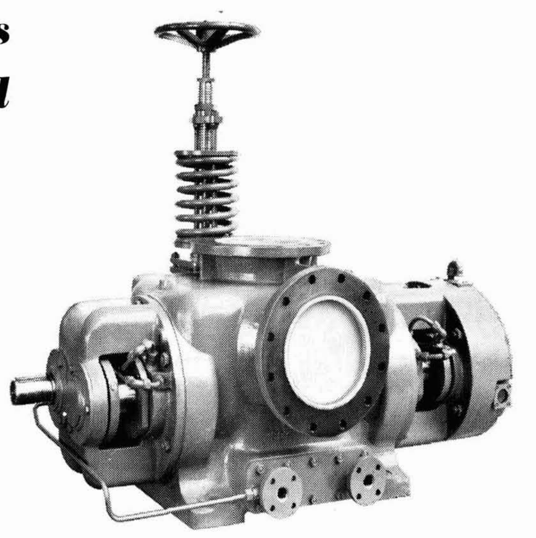

International Sugar Journal

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Published by
The International Sugar Journal Ltd.
23a Easton Street, High Wycombe,
Bucks., England.
Telephone: High Wycombe 29408
Cable: Sugaphilos, High Wycombe

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Annual Subscription: £3.00 or $10.00 post free
Single Copies: 40p or $1 post free

June 1972

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* * *

Tables de poids spécifique/composition de solutions de saccharose à 20°C. R. I. SAVAGE. *p.* 167–168

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* * *

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On considère l'effet de la compression et de la pré-compression de la canne sur la performance du moulin, suivi d'une discussion de la force hydraulique requise pour une vitesse donnée. On calcule la force hydraulique globale ainsi que les forces exercées sur les rouleaux d'alimentation et de sortie et on discute de l'effet de la vitesse sur le facteur variable *N*. On compare les forces hydrauliques requises pour un moulin à deux et à trois rouleaux et on montre que la substitution d'un moulin à deux rouleaux par un à troix rouleaux est justifiée.

* * *

Effet de l'application de pesticides au sol. R. S. KANWAR. *p.* 172

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Pläne für die Mechanisierung des Zuckerrohranbaus. R. T. SYMES. *S.* 163–166

Die richtige Planung eines Programms für die Mechanisierung des Zuckerrohranbaus wird in Form von vier Entwicklungsphasen einer Zuckerindustrie diskutiert. Die letzte dieser Phasen ist diejenige, bei der die Anbaufläche und die zur Verfügung stehenden Arbeitskräfte die völlige Mechanisierung erforderlich machen. Es werden weiter verschiedene Aspekte der Mechanisierung des Zuckerrohranbaus behandelt, darunter die Ermittlung der Kosten, die Wahl der optimalen Erntemethode, die Schulung der Arbeitskräfte sowie die Realisierung der Mechanisierungspläne.

* * *

Tabellen für das spezifische Gewicht und die Zusammensetzung von Saccharoselösungen bei 20°C. R. I. SAVAGE. *S.* 167–168

Der Autor veröffentlicht Tabellen, in denen die Zusammensetzung (g/100 cm³ und g/100 g) gegen das "scheinbare spezifische Gewicht" von Zuckerlösungen bei 20°C in Luft eingetragen ist. Die Ableitung der Werte wird ebenso erklärt wie die Anwendung der Tabellen zur Ermittlung der Gewichtsprozente Saccharose in einer hochviskosen Zuckerlösung.

* * *

Zweiwalzen-Rohrmühlen. Teil III. A. T. DE BOER. *S.* 169–172

Es werden der Einfluss der Zuckerrohrkompression und -vorkompression auf die Mühlenleistung sowie der für eine gegebene Geschwindigkeit erforderliche hydraulische Druck diskutiert. Es folgt eine Berechnung des hydraulischen Gesamtdrucks und der Drücke, die auf die Zuführungs- und Austragwalzen ausgeübt werden, sowie der Einfluss der Geschwindigkeit auf die Variable *N*. Die für eine Zweiwalzen- und eine Dreiwalzenmühle erforderlichen Drücke werden miteinander verglichen. Es zeigt sich, dass der Ersatz der Dreiwalzenmühle durch eine Zweiwalzenmühle zur Erzielung der gleichen Leistung gerechtfertigt ist.

* * *

Einfluss der Anwendung von Bodenpestiziden. R. S. KANWAR. *S.* 172

Der Autor diskutiert Ergebnisse von Versuchen, bei denen der Einfluss einiger Bodenpestizide auf den Zuckerrohraufgang, das Wachstum, die Stickstoffaufnahme und die Saftqualität ermittelt wurde.

Planificación para mecanización cañera. R. T. SYMES. *Pág.* 163–166

La planificación apropriada de una programa de mecanización cañera se discute en términos de cuatro fases de desarrollo de un industria azucarera, del cual la última es cuando los niveles de valor de la tierra y disponibilidad de mano de obra necesitan mecanización completa. Algunos aspectos de mecanización cañera se consideran, incluyendo evaluación de costes, selección del método óptimo de cosecha y instrucción de personal así como cumplimiento de planes para mecanización.

* * *

Tablas de gravidad específica y composición para soluciones de sacarosa a 20°C. R. I. SAVAGE. *Pág.* 167–168

Se presentan tablas de composición (g/100 cm³ y g/100 g) *versus* gravidad específica aparente en aire a 20°C para soluciones de sacarosa. La derivación de los dados se explica y se describe brevamente el uso de las tablas para determinar el peso de sacarosa % peso de un sirope de alta viscosidad.

* * *

Molinos de caña de dos mazas. Parte III. A. T. DE BOER. *Pág.* 169–172

Se consideran los efectos de compresión y precompresión de caña sobre el cumplimiento del molino, y se discute la fuerza hidráulica necesario para una dada velocidad. La fuerza hidráulica total y las fuerzas ejercido sobre las mazas de entrada y salida se calculan, y el efecto de velocidad sobre el factor variable *N* se discute. Se comparan las fuerzas hidráulicas requerido para molinos de dos y de tres mazas, y sustitución de un molino de dos mazas por uno de tres mazas para obtenir el mismo cumplimiento se demostra como justificado.

* * *

El efecto sobre caña de azúcar del aplicación al suelo de pesticidas. R. S. KANWAR. *Pág.* 172

Se discuten resultados de ensayos para determinar los efectos de algunas pesticidas, aplicado al suelo, sobre germinación, crecimiento, extracción de nitrogeno, rendimiento y calidad de jugo de la caña de azúcar.

THE

INTERNATIONAL SUGAR JOURNAL

VOL. LXXIV | JUNE 1972 | No. 882

Notes & Comments

World sugar balance, 1971/72

F. O. Licht K.G. recently issued their second estimate for the world sugar balance in the current crop year September 1971/August 1972, and the figures are reproduced below[1]:

	1971/72	1970/71	1969/70
	(metric tons, raw value)		
Initial stocks ..	18,482,274	21,115,302	19,289,669
Production	73,342,403	72,666,625	74,346,292
Imports	24,502,850	23,517,313	23,628,020
	116,327,527	117,299,240	117,263,981
Exports	24,786,865	23,944,660	23,839,763
Consumption ..	76,491,358	74,872,306	72,308,916
Final stocks	15,049,304	18,482,274	21,115,302

The overall figures show a production increase of 675,778 tons in 1971/72 or only 0·93%, while 1970/71 production was 1,679,667 tons or 2·26% *less* than that of 1969/70. With high sugar prices and even rationing in Ceylon and Cuba, the increase of consumption is set at only 2·16% compared with 3·55% between 1969/70 and 1970/71 and about 4% which has been usual during the past 25 years.

The reduction of the estimate for 1971/72 production, compared with the 1st estimate of the world sugar balance[2], is due mainly to reductions in the crop estimates for Cuba, the USSR, India and Mexico, and gives a figure more than 3 million tons short of the anticipated consumption in spite of the latter's growth having been restricted.

Commenting on the figures, C. Czarnikow Ltd. write[3]: "Final stocks of just over 15·0 million tons are not nearly sufficient to service a normal consumption growth in 1972/73 and it must be assumed that it will have to be curtailed again next year. Until the onset of the current statistical situation world consumption grew at an annual rate of 3·5–4·0% a year. An increase of 3·5% on Licht's consumption figure for 1971/72 indicates an outlet in the following year of 79,168,000 tons. To meet such a demand it would be necessary to increase production by nearly six million tons or to eat further into the already very low stocks. Certainly a marked expansion in production may be assumed but at this stage it can hardly be expected that it will be of the order of six million tons, while it is difficult to see how stocks can be much further reduced. Accordingly it appears that the availability of supplies will again be the limiting factor in consumption next year".

* * *

Sugar trade prospects in the 1970's

During an address to The Sugar Club in New York on the 13th April, Dr. A. VITON, Chief of the Sugar Branch of the F.A.O., offered three predictions in connexion with the prospects and opportunities for sugar during the balance of this decade.

First, he said, there will be considerably greater price fluctuations in the world free market than during the years 1965–70. Second, he predicted that the free market price fluctuations will be around a higher band than the 2·5 cents/lb of 1965-70. In his third prediction he forecast that consumption will continue to expand both in the rich and the poor countries but noted that it remains to be seen whether supplies will be sufficient to permit the rate of expansion envisaged on the basis of constant 1970 retail prices (i.e. by 21·0–22·5 million tons in the ten years to 1980).

Dr. VITON drew attention to the present high cost of establishing new industries. He put the cost of a new enterprise capable of producing 50,000 tons annually at $20–30 million and he questioned whether the existing climate was such as to encourage the investing of private capital. He went on to point out that the problem was further complicated by the low profit incentive normally inherent in investing in sugar the value of which, relative to other foodstuffs, has been steadily declining for years. The normal low level of world market prices is only made possible by higher domestic prices in the producing countries and the premium levels paid by the USA and the UK. Dr. VITON questioned whether it was right for the purchases of other developed countries to be underwritten in this way and he pointed out that production could be stimulated by changes in the price and quota structures when the ISA is renegotiated next year.

[1] *International Sugar Rpt.*, 1972, **104**, (11), 1–3.
[2] *I.S.J.*, 1972, **74**, 66.
[3] *Sugar Review*, 1972, (1071), 70.

UK sugar crop, 1971/72[1]

Sugar production from the 1971/72 beet harvest exceeded one million tons for the first time in the history of the industry. The campaign ended on the 24th February and provisional output is 1,075,000 tons, white value. Average sugar content was 16·56%, compared with the five-year average of 16·13%. The quantity of beet delivered to the 18 factories was a record 7,744,785 tons. representing a yield of 17·33 tons per acre, and was 1·4 million tons above the previous season's figure of 6,310,866 tons. Production of dried beet pulp was also a record at 669,000 tons. The average daily slice was 62,740 tons, the highest so far achieved.

* * *

South African sugar production, 1971/72[2]

The South African Sugar Association has announced that output for the season ended 30th April was a record 1,864,664 metric tons, against 1,398,972 tons in the previous season and the previous record of 1,822,266 tons in 1967/68. The Association says that early prospects for the 1972/73 season will be as good as in 1971/72 and that, if the world price of sugar remains around £60 a ton, export earnings should exceed 100 million Rand, compared with over 80 million Rand in the past season.

* * *

UK Sugar Board distribution payments

In view of recent changes in the level of the world price of raw sugar on the London Market, the Minister of Agriculture, Fisheries and Food made Orders under the Sugar Act 1956 increasing distribution payments on sugar from £6 to £12 per ton, with effect from the 26th April 1972; two days later the payments were reduced again, but to £10 per ton. A further reduction to £8 per ton was announced to take effect on the 16th May.

* * *

Booker McConnell Ltd. 1971 report

In Guyana, Bookers Sugar Estates made a record crop of 313,000 tons, compared with 258,000 tons in 1970 and 302,000 tons in 1969. The Company's policy is to expand sugar production, so long as this can be done profitably, by increasing factory capacity to match the new acreage planted to cane; the rate of growth will, however, depend on profit prospects and good industrial relations. The Nigerian Sugar Company made 24,000 tons of sugar compared with 27,000 tons in 1970, the fall being mainly attributable to poor weather and delays in the import of irrigation equipment, and causing a loss. Bookers Agricultural and Technical Services Ltd. increased turnover and profitability; its recommendations for the expansion of cane growing at Mumias in Kenya having been accepted, the development began in 1971. The study of the rehabilitation of the Indonesian sugar industry, made in partnership with Tate & Lyle Ltd., has been completed, while further projects in 1972 involve the Far East, the Caribbean, Latin America and Africa.

Fletcher and Stewart Ltd. had a reduced profit, caused by delays in large contracts owing to problems over credit facilities and contract terms; however, most of the difficulties have now been resolved. A new sugar factory should be completed in Pakistan in mid-1972 and further contracts for factories have been secured for the Philippines, Tanzania and Kenya.

* * *

European beet area, 1972

F. O. Licht K.G. recently published their second estimate of sowings for the 1972/73 beet crop[3]. The largest increase is, not surprisingly, that of 200,000 hectares for the USSR whose area is over half the European total, while smaller increases are expected in other countries of which the greatest are in France (20,000 hectares), Austria (10,000 ha) and Spain (21,000 ha). C. Czarnikow Ltd. have pointed out[4], however, that the Spanish Government has recently published a decree setting out production quotas of 780,000 tons of beet sugar and 45,000 tons of cane sugar. Since sugar outside these quotas would not benefit from the Government support system, a smaller area than Licht's 215,000 ha may well be planted to beet in that country.

The estimates are as follows, with the corresponding figures for 1971/72:

	1972/73	1971/72
	(hectares)	
Belgium-Luxembourg	100,000	92,000
France	410,000	390,000
Germany, West	324,000	318,362
Holland	108,000	102,228
Italy	265,000	259,417
Total EEC	1,207,000	1,162,007
Austria	49,049	38,930
Denmark	56,000	50,000
Finland	18,500	17,118
Greece	22,400	24,526
Ireland	34,236	29,200
Spain	215,000	194,006
Sweden	41,200	40,000
Switzerland	9,982	8,924
Turkey	155,000	158,497
UK	179,000	179,282
Yugoslavia	90,000	80,000
Total West Europe	2,077,367	1,982,490
Albania	6,000	6,000
Bulgaria	62,000	60,000
Czechoslovakia	180,000	180,000
Germany, East	220,000	214,000
Hungary	79,500	73,555
Poland	420,000	420,678
Roumania	195,000	190,000
USSR	3,500,000	3,300,000
Total East Europe	4,662,500	4,444,233
TOTAL EUROPE	6,739,867	6,426,723

[1] *British Sugar Beet Review*, 1972, **40**, 131.
[2] *Public Ledger*, 6th May 1972.
[3] *International Sugar Rpt.*, 1972, **104**, (12), 1.
[4] *Sugar Review*, 1972, (1068), 55.

Planning for sugar cane mechanization

By R. T. SYMES

(SHS Associates, 225 Wright Ave., Apt. G, Gretna, La., 70053 USA.)

THERE is a strong tendency in the sugar cane industry to fight against mechanization and especially mechanization of the harvest.

Among the most often mentioned reasons for not mechanizing are: the high capital investment required, the fear of introducing extraneous material into the mill and the fear that the introduction of mechanization will result in unemployment.

For the above reasons, mechanization is often delayed until too late and then the only salvation is "Crash Programming".

Crash programmes usually result in high expenditures of money—and often wasted money, besides wasted human effort, and often the result of a crash programme is a poor solution to the problem, but a solution which must be lived with since the time has run out.

It is submitted, in this paper, that the industry develops through definite phases, that there are signals indicating a possible phase change and that proper planning will assure a smooth transition from phase to phase.

Sugar industry phases

Phase I

In this phase, land is cheap, labour is cheap and abundant, extensive agriculture is practised, and animal power is used for most field operations. Since the mill is both expensive and complex the "Best Minds" are concentrated on this end of the operation. Yield, here used in the sense of sugar produced versus material passing over the mill scale, is of utmost importance.

Phase II

In this phase land becomes more expensive or labour availability decreases, while sometimes both may occur. This phase usually sees the introduction of tractors and the reduction or complete elimination of animal power. The mill and yield factors are still given first consideration, however.

Phase III

In this phase, land becomes more valuable owing to competition with other land use-demanding agencies. The labour force available for agricultural work decreases and becomes more expensive. Mechanical loading is introduced, thus offsetting the manpower decrease since in this way all of the labour force is available for cutting the crop. This is often a traumatic experience since it is discovered that the mechanical loader is a complex device and often a support organization has not been created or properly trained.

The mechanical loader introduces extraneous material along with the cane and it is necessary to change certain field practices and train the supervisory force in order to reduce the extraneous material introduction. The milling operation will have to learn to live with a certain amount of extraneous material and the yield falls a bit.

Phase IV

Land values and labour availability in this phase become such that complete mechanization of all field operations is required. The mill must take its part as a part of the process, no more important than any other part, and it is to be hoped that the "Best Minds" are now spread through all of the operation. Sugar produced per unit of land area may replace yield as the basis of judging production efficiency.

There are other factors which can and do affect the development of an industry. For example, no mention has been made of Government policy; however, it will be found that in most cases Government policies affect land value and labour, so that the net effect on the industry is as shown in the phases.

It could be said that there is a fifth phase. After an industry is fully mechanized, constant evaluation must be done; if not, the creeping rise of costs can often result in the dreaded crash programmes.

Planning tools

If the fact that the industry passes through the above phases is accepted, as outlined, it becomes obvious that it is possible to plan for each in advance.

There are several useful tools, which the planner can use in order to predict phase changes and to evaluate his work.

The writer has a cost curve covering fifty years of operations of a large sugar cane enterprise. The curve is keyed, by year, indicating the commercial introduction of new cane varieties, changes in field practices, the introduction of different machine systems, labour legislation, strikes and even such natural events as hurricanes and droughts. One interesting part of the curve shows a steady rise in harvesting costs; mechanical loading was introduced and when it reached a commercial scale, harvest costs went down.

This type of curve should be constructed to extend as far back as historical data will allow.

Several other curves are helpful to the planner. One should show the yearly availability of labour and factors which affect its availability. One operation, with which the writer is familiar, suffered a yearly reduction in labour availability of 25% and at the end of six years had only 10% of the original force.

It is also instructive to maintain a yearly yield curve and, plotted on the same chart, a curve showing the yearly production of sugar per unit of land area harvested. I have such a curve showing a constant drop-off in yield, but a slight rise in sugar produced per year.

Objectives

All planning must have an objective and in the case of the sugar industry the objective must be "Cheap Sugar". Actually, the objective is to stay in business; however, the production of cheap sugar will assure the future of the industry. Cheap sugar obviously means the most sugar in the bag with the smallest monetary outlay.

There are cases in the industry of the obvious misinterpretation of the above statement. Many times it seems expedient to eliminate some operations, thus not spending the money. This is a reduction of monetary outlay, but this can also reduce the sugar in the bag.

At one operation which entered into a period of diminished labour availability, the hand cleaning of ditches could not be done, but instead of making a cash outlay and mechanizing this operation the cleaning was just eliminated. This land is not in sugar cane at this time.

There are several things which the planner must keep in mind at all times:

One is that all sugar is produced in the cane plant; from the time that the cane is "killed" until the sugar is "in the bag", sugar is lost!

The planner must therefore see the entire operation as an entity and do his utmost to avoid sugar losses and damage to the coming crop.

Another, is that a mill is of value only so long as the land is in sugar cane. This is of great importance, especially since in many cases the planner may work for an organization which owns the mill, but not the land.

The writer is familiar with one organization in which all efforts were directed toward assuring the mill of high sugar content cane by urging the growers to produce less cane per unit area of land; the milling was profitable but the growers suffered and therefore put their land to other uses, and finally the mill was shut down, since there was not sufficient cane to justify its operation.

Decisions

I submit that for any sugar industry, which has not yet reached Phase IV, the first decision which must be made as the starting point for the planning is that concerning the final harvesting method which will be adopted.

There seems to be a strong fear that a new harvesting method will be developed and if a decision is made too soon, all the plans will have to be thrown out of the window.

Actually, as far as the planner is concerned, there are only two mechanical cane cutting methods, since all mechanical harvesters fall into two classes: the whole-stalk machines and those which cut or chop the cane as it is harvested.

There are commercially acceptable cane harvesters capable of cutting cane of any weight per unit of land area, whether grown in the bottom of the furrow, flat or on a ridge. There are machines which can cut on fairly steep slopes and under conditions of low flotation; but they all fall into the two classes mentioned above.

Chopped cane has considerable merit, but there is one danger inherent in chopped cane systems, and that is deterioration caused by the *Leuconostoc* organism. This organism inhabits the cane field and enters into any cuts or breaks in the cane rind. All mechanical cane harvesting systems, including mechanical loading, break or cut the cane, but the chopper-type systems create the most opportunity for the activity of the *Leuconostoc* organism.

The deterioration is accelerated by heat and humidity. There is a rule of thumb to the effect that chopped cane must be crushed within 14 hours in order to avoid undue deterioration; however, the planner must beware of rules of thumb. Each industry area has its own micro-climate, and the planner must obtain information within this micro-climate before making a chopped cane decision.

Even if 24-hour harvesting is contemplated, the transport network and the mill storage systems must be well planned if deterioration is to be avoided. Transport systems must always be designed so as to handle the cane with the greatest possible speed and transfer systems must assure quick turn-around of the transport system. Storage must always be minimized.

Once the whole-stalk *vs.* chopped cane decision is made, the rest of the cane handling system can be planned.

Cane handling systems

No matter which type of cane is to be handled, the systems follow a certain pattern, as follows:

Cut, Load, Infield Transport, Transfer, Final Transport, Mill Transfer.

Cane cleaning can be done as part of the cutting, loading, or transferring at the field or mill; it may also be done at all of these points.

Chopped cane must be handled in closed containers and the transport and transfer elements of the system may therefore vary from the comparable elements of a whole-stalk system.

Often, in discussing transport systems, the direct haul system handling of the cane is considered to be very advantageous. The fact is that the design envelope for infield transport and final transport is different.

When designing the infield transport system, it must be remembered that the units must be very manoeuvrable since they often have to turn at the end of the field and re-enter it. They must also have fairly high flotation not only for adverse weather conditions, but in order to avoid undue compaction and its adverse effect on the coming crop. Speed capability of over 15 m.p.h. (24 k.p.h.) is seldom necessary for the infield transport units.

The final transport system design involves consideration of maximum capacity within legal size limitations, the highest speed within legal and safety limitations and number of units which can be moved, by one prime mover, within legal limits.

The transferring of cane does involve double handling; however, cane may be cleaned as it is transferred and certain types of transfer will result in greater load density in the final transport system.

Load density is achieved by reducing the open spaces or voids between the individual canes and the voids which are created by the corners where the floor and the sides of the container join and where the sides and ends meet. Perfectly straight hand-loaded cane will have the greatest load density. Straight machine loaded cane, short chopped cane and cane hammered into the transport units by cranes or derricks, are all of fairly high load density. Bent or crooked, poorly piled mechanically loaded cane has the lowest load density. The presence of extraneous material, obviously, decreases load density.

There are a tremendous number of cane handling systems to choose from and often it is easier to copy one from another area; however, by doing this the planner is doing a disservice to himself and his organization. It is my opinion that the planner should always evaluate several systems (Table I).

Table I. Some elements for mechanized cane handling systems

Harvesters

Cut—Pile
Cut—Windrow (Lengthwise or Crosswise of Field)
Cut—Load (Chopper)

Loaders

Grab (For piled cane)
Grab (For windrowed cane)
Chopper (For piled cane)
Chopper (For windrowed cane)

Infield Transport

Trucks
Trailers
Carts
Bins

Transfer

Derricks
Net Unloaders
Grab
Dumping devices
Conveyors
Fork Lift
Lateral Slide (Bins)

Final Transport

Trucks
Trailers
Carts
Rail Cars
Barge

Mill Handling

Crane (Rotating)
Crane (Bridge)
Wheel Loader, Grab equipped
Fork Lift (Bins)
Rolling (Bins)
Rolling (Trucks, Trailers, Carts, Rail Cars)

Cleaning

Dry, on Harvester
Dry, on Loader
Dry, at Transfer
Dry, at Mill
Wet, at Mill

In order to set up a system evaluation study, the planner must have a thorough knowledge of the conditions in the area being studied. He must also gather knowledge of methods used in other areas. He must then set the capabilities in terms of cane weight handled per unit of time for each system element. He must also obtain information on or make an accurate estimate of the unit cost in terms of capital investment and manpower for each system element. It is then simple to find the cost per hour for each system element.

As an example, the planner might set up a statement as shown in Table II.

Table II

Machine	Harvester
Capital Cost	$49,000
Owning Cost/hour	$8.84
Operating Cost/hour	$7.47
Operator	1—$2.00
Cost/ton	$0·51

Owning cost per hour—Capital investment divided by depreciation hours plus a percentage representing insurance, taxes, interest on money, etc.

Operating cost/hour—The cost of fuel, oil, grease, filters, etc. plus the estimated cost of repairs for the lift of the machine divided by the depreciation hours.

Operator—In this case the machine uses one operator and the wage scale is $2.00 per hour.

Cost/ton—The sum of the owning cost per hour, the operating cost per hour and the operator hourly wage divided by the tons per hour capability of the harvester.

By setting up statements of this type for each system element and then grouping them into a system, the planner will find the system cost and cost breakdown, the number of men required and the system cost per unit of cane weight handled.

The planner will then evaluate the different systems on the basis of capital cost, and cost per unit weight of cane handled. He must then make another evaluation, i.e. whether or not the system is feasible for the conditions and type of manpower skills which will be available to work the system.

The planner must be as unbiased as possible during this phase of his work, but once the best system has been found he must be prepared to defend it with his life. Therefore he should investigate systems which, at first glance, appear to be unpractical as well as those which are in common use. Sometimes the result is surprising.

Often a system may have a higher capital cost, but a lower cost per unit of weight, than another when it follows that the total amount of cane handled by the system, per crop, multiplied by the cost difference and by the system depreciation life, will indicate whether or not the higher investment is of value.

Implementing the plans

While the planning should be done as early as possible in development of the industry, the plan does not have to be implemented immediately. Actually in most cases the implementation will take place in steps.

As an example, let us say that the industry is in Phase II and that a chopped-cane system has been selected as the final harvesting method, but that the current trend indicates that mechanical loading will be needed in four years and that mechanical cutting is possibly ten more years away.

Two directions can be taken in the implementation. Ten years of loader operation will allow complete depreciation of the loaders, so that they can be whole-stalk loaders. This would allow the use or conversion of some of the infield transport equipment to work with the whole-stalk loader. In cases where derricks are being used for transfer, they can also be modified to work in the system. The correct implementation in this case would be to acquire immediately one whole-stalk loader, modify enough units to work with it and start operating. This allows training for the operators, the formation of a support group and an opportunity to make any modifications in work methods or field conditions. This will allow full implementation of mechanical loading, when needed, and make the transitional period a smooth one.

There are several chopper-type loaders which can be used, and the plans can therefore be implemented by going toward chopped-cane loaders instead of waiting for the chopped-cane cutter. This would mean that when the cutter is introduced, the transport and transfer network would be compatible with the cane produced by this machine. In this case the procedure would be exactly as above, but cane derricks and carts for hand loading are not compatible with chopped-cane systems; therefore, they have to be replaced as mechanical loading progresses.

The second solution is best since it spreads the capital investment required in chopped-cane handling systems over a longer period of time. The first solution requires less capital investment in the preliminary stages but higher investments are required later. Actually the solution depends on the particular problems of a given area; often it is found that the two methods of implementing the plans can be blended into a final solution, and while the total investment for the entire plan will remain the same, this method may even cut the investment made per crop.

Even the best system will fail to attain the objective of "cheap sugar" unless it is well operated and operates under optimum field conditions.

As mechanization progresses, the required number of supervisors will decrease although quality supervision will become increasingly important. A supervisor who cannot operate a tractor will have difficulty knowing whether or not a machine is being operated to its full potential and if the machine is not being operated to its full potential, "cheap sugar" is not being produced. The supervisory force must know and understand the system; they need to know this, in order to understand the system production goals and if they understand the goals and the systems' capability of achieving them, they can then do their part.

Training programmes, therefore, must be planned, not just for machine operators and mechanics, but for all levels of supervision. This is a hidden investment which is essential to good operation.

Field layout is very important for every type of mechanical operation. The field efficiency of any machine is based on the length of row, or the length of the field. Short rows or fields, of course, mean that the machine spends a high percentage of its time turning at the ends, and this is time during which the machine is not doing the work it is planned to do; it follows that the longer the field, the higher will be the machine efficiency.

In the case of mechanical cutting, as the field length approaches 2000 feet (600 metres) efficiency increases, but after 2000 ft the efficiency curve flattens out, and consequently two thousand-foot fields are recommended. However the problem of moving heavily-laden infield transport units into and out of the field, without doing too much damage to the machinery and the soil, is best solved by having an escape road at the 1000-ft point (300 metres). A field laid out in this fashion will allow all operations to be carried out on a 2000-ft line, but will also allow loaded transport to leave at the 1000-ft point.

Whether the cane is grown in the furrow bottom, on ridge or bed, or on a flat surface, quality cultivation is of utmost importance. This type of cultivation will allow quality mechanical harvesting with little loss of sugar and reduce introduction of extraneous material into the cane. It is also good for the crop. Quality cultivation means assuring that the spacing between cane rows is as planned and that the ridges, in furrow or hilled-up cane, are maintained the same throughout their length. If contours are required, they must be as sweeping as possible. Naturally, all non-cane objects in the field should be removed; if not, they will invariably arrive at the mill and create problems in the relationship between those concerned with the mill and those in the field.

Conclusion

I have not tried to discuss all of the questions which must be answered in a good plan, since many of them are specific in that the answer will depend on local conditions. I also have dealt mainly with harvesting, since the capital investment is the greatest and the possibilities of traumatic experiences generally bear a direct relationship to investment. But my basic theme is that good planning will reduce the possibility of traumatic experiences.

Specific gravity/composition tables for sucrose solutions at 20°C

By R. I. SAVAGE

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A NEED has long been felt in this Laboratory for tables relating the composition of sucrose solutions with their apparent specific gravity (i.e. specific gravity in air) at 20°C. The tables of the American Society of Brewing Chemists[1] go some way towards meeting this need, but the range of compositions covered by them is only such as is of interest to brewers; and moreover the composition is expressed as a percentage by mass and not by weight. Another very useful table is Table 114 of Circular C 440[2] of the National Bureau of Standards, which gives apparent density at 20°C, apparent specific gravity at 20°C/20°C, and mass of sucrose per 100 ml corresponding to every 0·1 degrees Brix from 0 to 95. However, the use of this table for precise determinations of percentages of sucrose weight in volume necessitates a tiresome interpolation and a conversion of mass to weight.

The need for new tables has become more urgent as a result of the policy of metrication. Hitherto most specific gravity determinations have been carried out in this Laboratory at 60°F, which temperature is in some cases (e.g. beer) laid down by British law. Specific gravities of sucrose solutions at 60°F/60°F have been referred to the excellent tables of

[1] "Official Methods of Analysis of the AOAC" 10th Edn., 1965, p. 817.

[2] "Polarimetry, Saccharimetry and the Sugars". (National Bureau of Standards, Washington) 1942.

Table I. Composition (grams* per 100 cm³ of solution) and apparent specific gravities* at 20°C/20°C of sucrose solutions

Apparent specific gravity 20°/20°C*	*Third decimal of the apparent specific gravity** 0	1	2	3	4	5	6	7	8	9
1·00	0·00	0·26	0·52	0·77	1·03	1·29	1·55	1·81	2·06	2·32
1	2·58	2·84	3·10	3·36	3·62	3·87	4·13	4·39	4·65	4·91
2	5·17	5·43	5·69	5·95	6·21	6·47	6·73	6·99	7·25	7·51
3	7·77	8·03	8·29	8·55	8·81	9·07	9·33	9·59	9·85	10·11
4	10·37	10·63	10·89	11·15	11·41	11·67	11·93	12·19	12·45	12·72
5	12·98	13·24	13·50	13·76	14·02	14·28	14·54	14·80	15·07	15·33
6	15·59	15·85	16·11	16·37	16·63	16·90	17·16	17·42	17·68	17·94
7	18·20	18·47	18·73	18·99	19·25	19·51	19·78	20·04	20·30	20·56
8	20·83	21·09	21·35	21·61	21·88	22·14	22·40	22·67	22·93	23·19
9	23·45	23·72	23·98	24·24	24·51	24·77	25·03	25·30	25·56	25·82
1·10	26·09	26·35	26·61	26·88	27·14	27·40	27·67	27·93	28·20	28·46
1	28·72	28·99	29·25	29·52	29·78	30·05	30·31	30·58	30·84	31·10
2	31·37	31·63	31·90	32·16	32·43	32·69	32·96	33·22	33·49	33·75
3	34·02	34·28	34·55	34·82	35·08	35·35	35·61	35·88	36·14	36·41
4	36·68	36·94	37·21	37·47	37·74	38·01	38·27	38·54	38·81	39·07
5	39·34	39·60	39·87	40·14	40·41	40·67	40·94	41·21	41·47	41·74
6	42·01	42·27	42·54	42·81	43·08	43·34	43·61	43·88	44·15	44·41
7	44·68	44·95	45·22	45·49	45·76	46·02	46·29	46·56	46·83	47·10
8	47·37	47·63	47·90	48·17	48·44	48·71	48·98	49·25	49·52	49·79
9	50·06	50·33	50·60	50·87	51·14	51·40	51·67	51·94	52·21	52·48
1·20	52·75	53·02	53·29	53·56	53·83	54·10	54·38	54·65	54·92	55·19
1	55·46	55·73	56·00	56·27	56·54	56·81	57·08	57·35	57·63	57·90
2	58·17	58·44	58·71	58·98	59·26	59·53	59·80	60·07	60·34	60·62
3	60·89	61·16	61·43	61·71	61·98	62·25	62·53	62·80	63·07	63·34
4	63·62	63·89	64·16	64·44	64·71	64·98	65·26	65·53	65·81	66·08
5	66·35	66·63	66·90	67·18	67·45	67·73	68·00	68·28	68·55	68·83
6	69·10	69·38	69·65	69·93	70·20	70·48	70·75	71·03	71·30	71·58
7	71·85	72·13	72·41	72·68	72·96	73·24	73·51	73·79	74·07	74·34
8	74·62	74·90	75·18	75·45	75·73	76·01	76·29	76·56	76·84	77·12
9	77·40	77·68	77·95	78·23	78·51	78·79	79·07	79·35	79·62	79·90
1·30	80·18	80·46	80·74	81·02	81·30	81·58	81·86	82·14	82·42	82·70
1	82·98	83·26	83·54	83·82	84·10	84·38	84·65	84·93	85·21	85·49
2	85·77	86·06	86·34	86·62	86·90	87·18	87·46	87·75	88·03	88·31
3	88·59	88·87	89·16	89·44	89·72	90·00	90·28	90·57	90·85	91·13

*in air with brass weights

Table II. Composition (grams* per 100 grams* of solution) and apparent specific gravities* at 20°C/20°C of sucrose solutions

*Apparent specific gravity** 20°/20°C	*Third decimal of the apparent specific gravity** 0	1	2	3	4	5	6	7	8	9
1·00	0·00	0·26	0·52	0·77	1·03	1·29	1·54	1·80	2·05	2·31
1	2·56	2·81	3·07	3·32	3·58	3·83	4·08	4·33	4·58	4·83
2	5·08	5·33	5·58	5·83	6·08	6·33	6·58	6·82	7·07	7·32
3	7·56	7·81	8·05	8·30	8·54	8·79	9·03	9·27	9·51	9·76
4	10·00	10·24	10·48	10·72	10·96	11·20	11·44	11·68	11·92	12·16
5	12·39	12·63	12·87	13·10	13·34	13·58	13·81	14·05	14·28	14·52
6	14·75	14·98	15·21	15·45	15·68	15·91	16·14	16·37	16·60	16·83
7	17·06	17·29	17·52	17·75	17·98	18·21	18·43	18·66	18·89	19·11
8	19·34	19·57	19·79	20·02	20·24	20·46	20·69	20·91	21·13	21·36
9	21·58	21·80	22·02	22·24	22·47	22·69	22·91	23·13	23·34	23·56
1·10	23·78	24·00	24·22	24·44	24·65	24·87	25·09	25·30	25·52	25·74
1	25·95	26·17	26·38	26·60	26·81	27·02	27·24	27·45	27·66	27·88
2	28·09	28·30	28·51	28·72	28·93	29·14	29·35	29·56	29·77	29·98
3	30·19	30·40	30·61	30·82	31·02	31·23	31·44	31·65	31·85	32·06
4	32·26	32·47	32·67	32·88	33·08	33·29	33·49	33·70	33·90	34·10
5	34·30	34·51	34·71	34·91	35·11	35·32	35·52	35·72	35·92	36·12
6	36·32	36·52	36·72	36·92	37·11	37·31	37·51	37·71	37·91	38·10
7	38·30	38·50	38·69	38·89	39·09	39·28	39·48	39·67	39·87	40·06
8	40·26	40·45	40·64	40·84	41·03	41·22	41·42	41·61	41·80	41·99
9	42·18	42·38	42·57	42·76	42·95	43·14	43·33	43·52	43·71	43·90
1·20	44·09	44·28	44·46	44·65	44·84	45·03	45·22	45·40	45·59	45·78
1	45·96	46·15	46·34	46·52	46·71	46·89	47·08	47·26	47·45	47·63
2	47·81	48·00	48·18	48·37	48·55	48·73	48·92	49·10	49·28	49·46
3	49·64	49·83	50·01	50·19	50·37	50·55	50·73	50·91	51·09	51·27
4	51·45	51·63	51·81	51·99	52·17	52·35	52·52	52·70	52·88	53·06
5	53·23	53·41	53·59	53·77	53·94	54·12	54·30	54·47	54·65	54·82
6	55·00	55·17	55·35	55·52	55·70	55·87	56·05	56·22	56·39	56·57
7	56·74	56·91	57·09	57·26	57·43	57·61	57·78	57·95	58·12	58·29
8	58·46	58·64	58·81	58·98	59·15	59·32	59·49	59·66	59·83	60·00
9	60·17	60·34	60·51	60·68	60·85	61·02	61·18	61·35	61·52	61·69
1·30	61·85	62·02	62·19	62·36	62·52	62·69	62·86	63·03	63·19	63·36
1	63·52	63·69	63·85	64·02	64·18	64·35	64·51	64·68	64·84	65·00
2	65·17	65·33	65·49	65·66	65·82	65·99	66·15	66·31	66·48	66·64
3	66·80	66·96	67·13	67·29	67·45	67·61	67·77	67·93	68·09	68·26

*in air with brass weights.

SCHEIBLER[3] for 15°C, which give composition both in percentage weight/weight and percentage weight/volume, an adjustment for the temperature difference (15·56°C to 15°C) being made when precise figures were required. As part of the process of metrication the Fahrenheit temperature scale is expected to disappear from the statute book, and in future specific gravities will be determined at 20°C.

By a fortunate coincidence this additional need for 20°C tables has arisen at just the same time as means have become available for satisfying it. The acquisition of an electronic calculator has made it possible to calculate the two new Tables I and II. Starting from the National Bureau of Standards Table 114 the grams (mass) per 100 ml of solution corresponding to every 0·01 of apparent specific gravity was calculated by linear interpolation. The figures were converted from grams (mass) to grams (weight) and simultaneously adjusted for the difference between the 1901 litre and the cubic decimetre. By linear interpolation between the weights thus derived percentages of sucrose weight/volume were obtained corresponding to every 0·001 of apparent specific gravity. This gave Table I. Every entry in this table was next divided by its corresponding density (i.e. by the specific gravity as shown in the table and simultaneously by the density of water in air at 20°, namely 0·997142 gm/cm³) and so Table II was obtained.

A particular use of the tables may be of interest. Suppose that one requires the percentage of sucrose weight in weight in a syrup which is too viscous to handle in a pycnometer. Exactly 10·00 grams of the sample is weighed, dissolved in water and diluted to exactly 100 cm³ at 20°C. The S.G. 20°/20°C is determined and the figure found referred to the weight/volume table. This will give the number of grams of sucrose in 100 cm³ of solution, i.e. in 10 grams of sample. Moving the decimal point one place to the right therefore gives the result required, namely the percentage of sucrose weight in weight.

Summary

The well known data of Plato are presented in the form of two new tables of composition versus apparent specific gravity at 20°C. For ease of reference and of interpolation, both tables are arranged in uniform increments of specific gravity. Details are given of the mode of derivation of the new tables.

[3] "Die Gehaltsermittelung der Zuckerlösungen durch Bestimmung des specifischen Gewichts derselben" (R. Friedlander & Sohn, Berlin) 1891.

Two-roller cane mills

A reappraisal in the light of value engineering of milling

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PART III

Contrary to the conditions mentioned above the mass of cane is usually compacted in a chute or by some other means of feeding arrangement prior to entering the mill.

Compacting in the mill is effected in this case from I_{c1} to I_w and by the feeding arrangement from I_{cb} to I_{c1}, where I_{c1} = fibre index at section AA of Fig. 2.

Compressing cane at a certain ratio, when starting from a pre-compacted condition at section AA, requires a larger hydraulic force to be exerted on the rollers than when starting from cane under no pressure.

At an identical work opening W the compression ratio C', performed in the mill, however, is identical with the compression factor C_o.

Hence:

$$C' = \frac{I_{c1}}{I_w} = C_o \qquad (43)$$

It is evident that, nevertheless, the resulting force F will then be larger than that derived from equation (40).

It can be demonstrated that in the case of pre-compacted cane entering the mill the compression factor C_o must be multiplied by the compression factor due to the pre-compression. Hence:

$$C_1 = C_o \frac{I_{cb}}{I_{c1}} = \frac{I_{cb}}{I_w} \qquad (44)$$

where C_1 = compression factor to be taken into account for calculating the required total force, when pre-compacted cane is compressed.

When integrating equation (39), HUGOT arrived at the constant 30 in equation (40).

It is not very likely, however, that this should be a constant. The value 30 would only be valid occasionally for conditions identical with the average conditions of JENKINS' experiments. Increasing the mill velocity, for instance, while leaving the thickness of the mat of cane constant, would proportionally increase the quantity of juice expressed and the flow velocity of juice through the mat would likewise be increased.

It is known from hydrodynamics that a larger pressure difference is required to create the increased velocity and that, in general, the required pressure difference is proportional to a power of the flow velocity.

Evidently, a larger hydraulic force F is required as well.

In equation (40) this would find expression in a larger value of the "constant" and it would be more satisfactory to substitute a variable N for the constant 30.

On substituting at the same time $C = \frac{I_{cb}}{I_w}$ in equation (40) it follows that:

$$F = \frac{N\,DL\sqrt{\frac{W}{D}}}{10^8\,(\frac{I_{cb}}{I_w})^6} \text{ kg f} \qquad (45)$$

It should be noted that in this formula F is extremely sensitive to changes in I_{cb} and I_w, these being in the 6th power.

According to the principle of equation (44) the hydraulic force component exerted on the feed roller of a three-roller mill will be:

$$F_1 = \frac{N\,DL\sqrt{\frac{W_1}{D}}}{10^8\,(\frac{I_{cb}}{I_{w1}})^6} \text{ kg f} \qquad (46)$$

and on the delivery roller:

$$F_2 = \frac{N\,DL\sqrt{\frac{W_2}{D}}}{10^8\,(\frac{I_{cb}}{I_{w2}})^6} \text{ kg f} \qquad (47)$$

According to HUGOT[37,38] the total hydraulic force:

$$F = F_1 + F_2 \qquad (48)$$

Whereas $\frac{I_{w1}}{I_{w2}} = \frac{W_2}{W_1}$

it follows that by adding equation (46) to (47):

$$F = \frac{N\,DL\left[(\frac{W_2}{W_1})^6\sqrt{\frac{W_1}{D}} + \sqrt{\frac{W_2}{D}}\right]}{10^8\,(\frac{I_{cb}}{I_{w2}})^6} \text{ kg f} \qquad (49)$$

Whereas $W_2 \simeq \frac{1}{2}W_1$, the form could be simplified with reasonable approximation to:

$$F = \frac{1{\cdot}02\,N\,DL\sqrt{\frac{W_2}{D}}}{10^8\,(\frac{I_{cb}}{I_{w2}})^6} \text{ kg f} \qquad (50)$$

Using this formula, the writer determined the value of N from the data of 31 first-extraction mills, which were available from the Java Experimental Station's statistics.

Among these mills there was one two-roller mill.

[37] "La Sucrerie de Cannes" (Dunod, Paris), 1970, p. 12.

[38] HUGOT, *transl.* JENKINS: "Handbook of Cane Sugar Engineering." (Elsevier, Amsterdam). 1960, p. 115.

In an attempt to find a relation between N and the velocity, the values found were plotted in the diagram in Fig. 5, using a logarithmic scale for the N-axis and a linear scale for the v-axis.

Taking into consideration that all mills were working under different conditions and that the speed ranges were within relatively narrow limits (3·66–6·70 m/min), the writer realizes that it is hardly scientifically justified to derive a conclusion from the figures obtained.

Nevertheless, when observing the plotted values, whilst excluding 4 cases of extremely high and 4 cases of extremely low values, a remarkable and interesting tendency may still be observed.

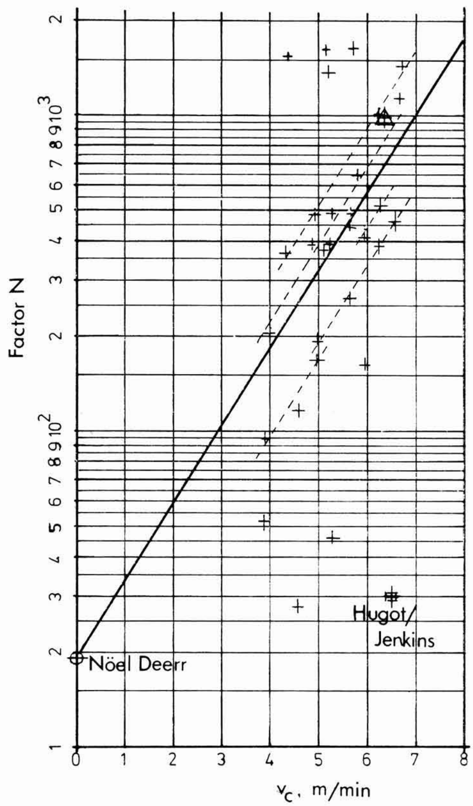

Fig. 5

This tendency was approached by a straight line in the diagram, of which the point $v_c = 0$ coincides with the value derived from DEERR's results under static conditions.

For this point the integration (40) must be performed from equation (38) and this gives $N_o = 19$.

When observing the diagram, it would seem that a number of parallels having a similar tendency as the mean line could be drawn. This phenomenon is indicated with dotted lines. There will very likely be a number of other parameters that influence the factor N, e.g. fibre content, juice viscosity, porosity of the mat of cane, particle size and particle size distribution, etc.

The available data unfortunately did not show a very significant relation with any of the parameters mentioned. Finding this relation would be the subject of extensive scientific research.

For the time being we shall confine ourselves to the mean line.

For this mean line the following relation between N and v_c could be derived:

$$\log N = 10^{(0{\cdot}246 v_c + 1{\cdot}278)} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (51)$$

In what follows this formula will be used for better or worse.

The allowable hydraulic force exerted on the top roller is limited by the size of the journals and whereas N is dependent on the velocity, it follows from equation (50) that the extraction, represented by I_{w2}, is dependent on and limited by the velocity and the maximum allowable hydraulic force. SPOELSTRA[39] came to a similar conclusion empirically.

At a velocity exceeding the limits mentioned the pressure required to extrude the juice outbalances the hydraulic force exerted on the rollers and the top roller rises so that the proportion W/D increases.

It is evident that the fibre index is then reduced and consequently the extraction is reduced accordingly.

As pointed out earlier, the hydraulic force reacts very susceptibly to this action and a new equilibrium is established at a reduced extraction level.

The object of a sound engineering is to proportion the mills in such a way as to balance the design grinding rate and the extraction. As has been demonstrated, the velocity has a significant influence on this process.

It may be seen in Fig. 5 that the value of N for a two-roller mill, indicated by a triangle, is higher than the average value. Although a substantial number of three-roller mills give a similar value, it would seem logical in connexion with the remarks made above that for a two-roller mill a relatively larger value of N is required.

From the available data it would seem a reasonable approximation if for a two-roller mill a 30% higher value for N would be applied than for a three-roller mill.

The approximate position of the constant 30 of HUGOT's formula (Equation 40) is indicated by means of a square and it appears that it is far below the practical values.

Obviously, the prevailing conditions in a mill, viz. the flow direction of the juice relative to the fibre, the flow velocity and the hydraulic conditions of the mat of cane, are different from the conditions in JENKINS' experiments.

[39] *Proc. 13th Congr. I.S.S.C.T.*, 1968, 1628–1631.

Hydraulic force required under dynamic conditions in a two-roller mill compared with a three-roller mill

The following data are a summary from the calculations above:

	2-roller mill	*3-roller mill*
size	34 × 66 in	32 × 60 in
D	864 mm	813 mm
L	1676 mm	1524 mm
Journals	415 × 540 mm	380 × 500 mm
All. hydr. force	448 tons	380 tons
cos α	0·825	0·825
$\frac{W_1}{D}$	0·0257	0·0602
$\frac{W_2}{D}$	—	0·0301
W_1	22·2 mm	48·8 mm
W_2	—	24·4 mm
h_c	178 mm	191 mm
I_{w_1}	0·58 kg/litre	0·29 kg/litre
I_{w_2}	—	0·58 kg/litre
f	13%	13%
γ_{cb}	0·63 kg/litre	0·63 kg/litre
γ_{c1}	0·70 kg/litre	0·70 kg/litre
v_c	10 m/min	10 m/min

According to equation (16):

$$I_{cb} = \frac{13 \times 0{\cdot}63}{100} = 0{\cdot}082$$

$$I_{c1} = \frac{13 \times 0{\cdot}70}{100} = 0{\cdot}091$$

According to equation (51), at $v_c = 10$ m/min, $N = 10^{3{\cdot}738} = 5475$ for a 3-roller mill, and $N = 1{\cdot}30 \times 5475 = 7120$ for a 2-roller mill.

The required hydraulic force for a 2-roller mill according to equation (45):

$$F = \frac{7120 \times 1676 \times 864 \times 0{\cdot}0257}{10^8 \left(\frac{0{\cdot}082}{0{\cdot}58}\right)^6} = 2{,}060{,}000 \text{ kg f}$$

and for a 3-roller mill according to equation (50):

$$F = \frac{1{\cdot}02 \times 5475 \times 1524 \times 813 \times 0{\cdot}0301}{10^8 \left(\frac{0{\cdot}082}{0{\cdot}58}\right)^6}$$

$$= 1{,}500{,}000 \text{ kg f.}$$

Whereas for the 2- and the 3-roller mill only 448 and 380 tons respectively are allowable, it is clear that these forces are insufficient to realize the required extraction.

Under the given conditions the top roller will lift until a new equilibrium is attained at a reduced extraction level of about 61 and 62% with the 2- and the 3-roller mill respectively.

Though correct under static conditions, it appears that the calculated mill dimensions are unsuitable to perform the design extraction under the prevailing hydrodynamic conditions.

The following mill dimensions could be calculated by trial and error to satisfy the design criteria under dynamic conditions:

(*a*) *Two-roller mill*—Size 40 × 78 in (1016 × 1980 mm), running at $v_c = 7{\cdot}04$ m/min, working at 465 tons hydraulic force to effect 68% extraction. Increasing the hydraulic force up to the allowable maximum of 650 tons would increase I_w to about 0·615, corresponding to an extraction $E_e = 69{\cdot}3\%$.

(*b*) *Three-roller mill*—Size 36 × 72 in (914 × 1828 mm), running at $v_c = 7{\cdot}7$ m/min, at the maximum allowable hydraulic force of 540 tons in order to realize the design extraction of $E_e = 68\%$. The grinding rate, however, should then be slightly reduced to about 96 t/h. Increasing the grinding rate to the design criterion of 100 t/h would reduce the extraction slightly.

CONCLUSIONS

(i) Expressed in terms of grinding rate and extraction it is possible to realize an identical performance with a two-roller mill as with a three-roller mill.

(ii) The weight of the 2 rollers of a two-roller mill of the size required to effect an identical performance as a three-roller mill of a given size nearly approaches or is slightly less than the weight of the 3 rollers.

(iii) As was summarized in a previous paper by the writer[14], the two-roller mill has numerous attractive features from the physical and operational points of view compared with a three-roller mill, without having a single disadvantage except perhaps for the larger unit weight of the rollers.

(iv) From the preceding conclusions it follows that it is feasible to substitute a two-roller mill for a three-roller mill from the point of view of obtaining an identical performance.

(v) The extraction performed by any mill of a certain size working cane of certain physical conditions is limited by the grinding rate, the required minimum circumferential roller velocity to effect that grinding rate under the given conditions and by the allowable hydraulic force exerted on the rollers.

Symbols and Indices

Symbol	*Description*	*Units*
q	Specific fibre rate	g/dm² (gram mass/dm²)
q_o	Reduced specific fibre rate	g/dm²
I	Fibre index	kg/litre (kg mass/litre)
V	Escribed volume per unit of time	dm³/min or litres/min
Q	Grinding rate or, Mass-flow velocity of cane through the mill or, Cane throughput.	t/h (metric ton mass/hr)
f	Fibre content of cane or, Mass of (dry) fibre % mass of cane	% mass
v	Velocity	m/min
F	Dimension factor	dependent
	or, in another connexion, Hydraulic force on top roller	kg f (kg force)
D	Roller diameter	mm
L	Roller length	mm
W	Work opening between the rollers = distance between the circumferences of two co-operating rollers in operation, reduced to the corrected roller diameter D_o	mm
h	Height of a vertical normal section through the mat of cane at any point of the flow of cane to, or through the mill.	mm
c	Compression factor (general)	dimensionless
C	Compression factor in a special case	dimensionless
E	Extraction rate = mass of cane juice extracted or expressed % mass of undiluted juice in cane	% mass

Symbol	*Description*	*Units*
η	Efficiency factor	dimensionless
t	Time	min (minute)
B	Bulk or volume of mass	dm^3 or litres
M	Mass	metric tons (mass)
		kg (mass)
		g (mass)
N	Variable factor	
γ	Specific gravity or density	kg/litre or g/ml
α, β, γ	Angles	
μ	Coefficient of friction	dimensionless
p	Factor for grooving	dimensionless

Index	*Meaning*
c	At the circumference or, Cane
e	At the entrance or, Effective
d	At the discharge side

Index	*Meaning*
h	Horizontal component
v	Vertical component
r	Radial or, reabsorption
t	Tangential *or* Theoretical *or* Terminal
i	Initial
w	At the work opening
n	At the point of nip
j	Of juice
f	Of fibre
o	Original *or* no-void *or* Reduced to a certain reference dimension *or* corrected *or* Natural *or* Undiluted.
E	Expressed or extracted.
$'$ $''$	Indication for an interim operation in the mathematical process
1, 2, 3	Case 1, case 2 etc. *or* sequence 1, 2 etc.
α, β, etc.	At the angle α, β, etc.
AA, PP, MM, etc.	At the plane of the lateral section at AA, PP, MM, etc.

Effect of soil application of pesticides on cane

By R. S. KANWAR*

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FIELD trials were conducted on non-saline and saline sandy loam soils at the Indian Agricultural Research Institute, New Delhi, during the 1968/69 and 1969/70 crops, to study the effect of soil application of "Telodrin", gamma-BHC and "Endrin", three chlorinated hydrocarbon pesticides, on germination, growth, nitrogen nutrition, juice quality and yield of sugar cane in the presence and absence of "Agallol" treatment of seed cane and at four different levels of nitrogen, viz. 75, 125, 175 and 225 kg nitrogen per hectare. The pesticides were applied as emulsions over the seed setts in furrows at the time of planting.

The results showed that soil application of "Telodrin", gamma-BHC and "Endrin" conferred several non-pesticidal beneficial effects on the cane crop, the most important being: improvement in germination, tiller population and millable stalk number; enhanced crop growth and millable stalk length; retardation of nitrification and reduction in nematode population in soil; increased availability of nitrogen and phosphorus to the plants and marked improvement in nitrogen efficiency.

On non-saline sandy loam soil, soil application of "Telodrin" and gamma-BHC resulted in significant increase in cane yield. "Telodrin" proved more effective than gamma-BHC and was significantly superior to the latter pesticide. "Telodrin" and gamma-BHC gave 95·2 and 83·8 metric tons cane yield per hectare as against 68·8 metric tons in the no-pesticide treatment.

In view of more efficient utilization of nitrogen by cane under treatment with "Telodrin" and gamma-BHC pesticides, the optimum dose of 125 kg nitrogen per hectare as recommended at present for sugar cane in North India can be reduced to 75 kg nitrogen per hectare. This was evident from a significant pesticide-nitrogen interaction in 1968/69. In pesticide treatments with "Telodrin" and gamma-BHC, the maximum yield level was attained at the lowest level of nitrogen, viz. 75 kg per hectare, which gave significantly higher cane yield than the control. In the no-pesticide treatments, however, the maximum yield was recorded with 125-kg nitrogen level and was a significantly higher yield than that of the control. The 75-kg nitrogen level did not increase cane yield significantly over control in the no-pesticide treatment. Cane yield during pesticide treatments with "Telodrin" and gamma-BHC at 0, 75 and 125 kg nitrogen levels was 84·0, 98·8, 97·7 and 74·3, 87·5, 85·8 metric tons per hectare, respectively, as against 59·9, 66·9 and 72·4 metric tons in the no-pesticide treatments.

The results also demonstrate that the low cane yields obtained on saline soil with high water table, can be increased tremendously by soil application of pesticides such as "Telodrin", "Endrin" and gamma-BHC. Application of 150 kg nitrogen per hectare with pesticide treatments using "Telodrin", "Endrin" and gamma-BHC gave cane yields of 93·4, 96·4 and 83·2 metric tons per hectare as against 65·9 metric tons in the case of the same dose of nitrogen applied without pesticide treatment. "Telodrin" and "Endrin"-treated cane gave significantly superior yield responses to nitrogen compared with the no-pesticide treatments. The yield differences amongst the three pesticides were non-significant.

On non-saline sandy loam soil, "Agallol" treatment of seed cane proved beneficial for improving germination, plant population and ultimately yield, but it did not show such effect on saline soil.

* Economic Botanist Sugar cane

Sugar cane agriculture

Chlorotic streak re-infection from soil is favoured by the addition of organic material. C. RICAUD. *Sugarcane Pathologists' Newsletter*, 1971, (6), 10.—Although the short hot water treatment of setts (52°C for 20 minutes) is highly effective against chlorotic streak, re-infection can and does take place in the field at a later stage. Experiments are described which indicate that the presence of organic matter, added experimentally in the form of muds and molasses, favours re-infection.

* * *

Hot water treatment and smut. G. L. JAMES. *Sugarcane Pathologists' Newsletter*, 1971, (6), 11–12.—Data were collected from two field experiments to ascertain whether hot water treatment of setts for ratoon stunting disease (2 hr at 50·5°C) also checks the development of smut in the subsequent plant crop. This was found to be so.

* * *

Sugar cane naming systems round the world. J. DANIELS, P. B. HUTCHINSON and J. C. SKINNER. *Sugarcane Pathologists' Newsletter*, 1971, (6), 13–15.—This is a continuation of a previous article which discussed naming systems in South Africa and Hawaii. In this article there are details of the naming systems used in the United States, Puerto Rico and Mexico.

* * *

Progress report on the ecology of *Epitettix hiroglyphicus* Matsumura, an insect vector of sugar cane white leaf disease. Y. S. PAN and S. L. YANG. *Sugarcane Pathologists' Newsletter*, 1971, (6), 16–17.—This leaf hopper was shown to be the vector of white leaf disease of sugar cane in Taiwan in 1967. Since then the insect has been closely studied. This paper is a summary of the results obtained in the last two years. Selection of sugar cane varieties, which are resistant to the insect, appears to be a practical method of controlling it.

* * *

Further improvements in leaf scald resistance testing. C. RICAUD. *Sugarcane Pathologists' Newsletter*, 1971, (6), 18–19.—Modifications have been devised for the method of leaf scald resistance testing described earlier[1]. These are described for the benefit of those interested in the method.

* * *

The interpretation of results from Fiji disease resistance trials. P. B. HUTCHINSON, J. DANIELS and A. A. HUSAIN. *Sugarcane Pathologists' Newsletter*, 1971, (6), 19.—Resistance testing of sugar cane clones in insectaries is now possible since it has been found that the time taken to produce symptoms (galls on leaves) is related to resistance. This is measured in terms of the SD50 or number of days required for symptoms to appear on 50% of the replicates, regression being calculated using a standard clone of known resistance on the international rating of 0–9.

* * *

Some observations on the insect transmission of sugar cane mosaic virus. K. S. BHARGAVA, R. D. JOSHI and S. M. A. RIZVI. *Sugarcane Pathologists' Newsletter*, 1971, (6), 20–21.—An account is given of studies on the insect vectors of sugar cane mosaic in India. Three of these are recorded as vectors for the first time, i.e. *Longiunguis sacchari*, *Lipaphis pseudobrassicae* and *Rhopalosiphum rufiabdominalis*. Results are tabulated. Six aphids could transmit strain B of sugar cane mosaic virus from cane to cane, maize or sorghum, from maize to cane and maize, and from sorghum to cane and sorghum. The efficiency of transmission varied from aphid to aphid and from host to host.

* * *

A standardized naming system for sugar cane clones. J. DANIELS. *Sugarcane Pathologists' Newsletter*, 1971, (6), 22–25.—With the help of sugar cane breeders a list of naming systems in current use around the world has been drawn up and is here reproduced and discussed.

* * *

Names of sugar cane clones past and present. J. DANIELS. *Sugarcane Pathologists' Newsletter*, 1971, (6), 26–36.—A list of sugar cane clone names and their derivations published by C. O. GRASSL and much used by cane breeders and pathologists has been revised and is here presented.

* * *

Differential tolerance of sugar cane varieties to herbicides. R. W. MILLHOLLON. *Sugarcane Pathologists' Newsletter*, 1971, (6), 38–39.—The increasing use of chemical weedkillers in sugar cane and the physiological abnormalities they may cause in cane can affect the sugar cane pathologist in two ways. He may be called upon to diagnose acute phytotoxicities or "new diseases" and in resistance trials he may have the interaction of pathogen and variety confounded by the interaction of herbicide and variety. The several factors that may influence herbicide-variety interaction are discussed.

[1] RICAUD: *Sugarcane Pathologists' Newsletter*, 1969, (2) 25–26.

Cell death patterns in sugar cane stalk tissue following injury and flowering. C. E. BARE, A. J. PAPPELIS and W. E. SCHMID. *Sugarcane Pathologists' Newsletter*, 1971, (6), 41–44.—This paper summarizes the views of Dr. PAPPELIS and his associates on the relationship between red rot infection and pith formation. Some factors that affect pith formation in sugar cane are discussed. A fuller account of experimental results was published in *Sugar J.*, 1971, **33**, (9), 30–32[1].

* * *

Current programs in sugar cane disease research centres. VIII. Mozambique. A. R. NORONHA. *Sugarcane Pathologists' Newsletter*, 1971, (6), 45–46. Smut and ratoon stunting are at present the most important diseases of cane in Portuguese East Africa; leaf scald and yellow wilt are also potentially dangerous. Work in progress involves assessment of the losses caused, roguing and search for resistant varieties.

* * *

A sugar cane clone apparently immune to RSD. C. A. WISMER. *Sugarcane Pathologists' Newsletter*, 1971, (6), 46.—A Hawaiian clone H60-6909, a symptomless carrier, failed to transmit ratoon stunting disease to indicator clones after repeated inoculations and appears to be immune, especially as seedlings from crosses of this clone with others also failed to become infected after two inoculations.

* * *

Methods for testing the resistance of sugar cane to disease. VII. Gumming disease. C. RICAUD. *Sugarcane Pathologists' Newsletter*, 1971, (6), 47–50.—This is one of a series of articles dealing with different sugar cane diseases. Gumming disease is spread by wind-blown rain. The bacteria (*Xanthomonas vasculorum*) ooze out of wounds in the characteristic leaf stripes and are washed and carried by rain droplets. Infection takes place through wounds, e.g. leaves or stems rubbing against one another in the wind. A resistance test which makes use of this natural method of spread was originally designed by NORTH in Australia. The procedure at present adopted in Mauritius is described; it is basically the same, with some slight modifications.

* * *

Strains of sugar cane mosaic virus and phytosynthetic rate in Louisiana. J. E. IRVINE. *Sugarcane Pathologists' Newsletter*, 1971, (6), 50–52.—The effect of mosaic disease on the chlorophyll of the sugar cane plant is discussed. This paper summarizes studies comparing the effects of symptoms produced by different strains of sugar cane mosaic on the normal photosynthetic rate of two differential host and four commercial cane varieties. Results show that a variety of sugar cane may respond differently in rates of photosynthesis when infected with different strains of mosaic virus. Conversely one strain of sugar cane mosaic may produce different effects on the rates of photosynthesis of different sugar cane varieties. What may be true for one variety or strain may not be true for all.

Leaf scald at Mackay. ANON. *Producers' Rev.*, 1971, **61,** (3), 63.—An intensification of the disease in this cane growing area of Queensland, especially in the Pleystowe region, is recorded. The number of diseased farms has now doubled to 30, and a disquieting feature is that the disease has been found some distance from the main centres of infection.

* * *

Some changed thinking about the merits of cover crops. N. J. KING. *Producers' Rev.*, 1971, **61,** (3), 71. Today there is less value attached to the nitrogen fixing properties of leguminous cover crops than to their value in protecting land from erosion in fallow periods. In badly infected nut grass areas the use of legumes would reduce the nut grass problem.

* * *

Optimum requirement of sugar cane setts for planting of different varieties under Tarai conditions of Uttar Pradesh. U. S. SINGH, M. M. S. SAXENA and –. SHRINATH. *Indian Sugar*, 1970, **20,** 601–603.—Much work has been done in the past in determining the optimum seed rate for different varieties in different tracts but there is a paucity of information regarding optimum seed rate in the Tarai areas of the State. Experiments, carried out in order to fill this gap, are reported. A high seed rate of 53·5 thousand setts/ha was found to be the best for Tarai conditions but further work is needed.

* * *

Studies on the infection of *Ceratocystis paradoxa* **on the standing canes of sugar cane varieties.** D. PADMANABHAN and N. J. AHMED. *Indian Sugar*, 1970, **20,** 605–612.—A total of 73 varieties of sugar cane were tested for resistance to pineapple disease (*Ceratocystis paradoxa*); 23 were resistant, 33 moderately resistant and 17 susceptible. Some of the agronomically promising varieties were among those that were resistant. Pineapple disease not only attacks the growing cane stem but is troublesome with setts causing decay in the soil and failure to germinate.

* * *

Blue heliotrope, a difficult weed to control. C. D. JONES. *Cane Growers' Quarterly Bull.*, 1971, **34,** 113. There are some 250 species of *Heliotropium.* That known as blue heliotrope in Queensland cane fields is *Heliotropium amplexicaule* and is especially troublesome in the Isis area. Mature plants with their deep tap roots are difficult to eradicate and any fragment of root may produce a new plant. Spot spraying with "Tordon 50D" (an expensive herbicide) has given good results in some areas.

* * *

Current methods of cane grub control in Queensland. G. WILSON. *Cane Growers' Quarterly Bull.*, 1971, **34,** 113–117.—There are two groups of cane grub in Queensland, those with a one-year and those with a two-year life cycle. The only soil insecticide effective against all species of cane grub is BHC (benzene hexachloride), which is commonly used as No.

[1] *I.S.J.*. 1972, **74,** 109.

20 (approx. 20%) crude BHC dust, containing 2·6% of the active principle, gamma BHC. Five basic methods of using this soil insecticide, according to circumstances, have been developed and are discussed in turn.

* * *

Vine weeds in the Herbert River District. O. W. D. MYATT. *Cane Growers' Quarterly Bull.*, 1971, **34,** 121–123.—The vine weeds in Queensland cane include Cupid's flower (*Ipomoea quamoclit*), red morning glory (*I. angulata*), prickly cucumber (*Cucumis metuliferus*), stinking passion fruit (*Passiflora foetida*) and pink convolvulus (*Ipomoea triloba*). The last mentioned, an annual thought to have been accidentally introduced to Queensland in the early 1950's, is by far the worst pest. All these weeds are vulnerable to the hormone type of weedkiller which, when the weed is growing in mature cane, has to be applied by overhead boom sprays, power misters or from aircraft which is, of course, expensive.

* * *

Wireworm control. A. A. MATTHEWS. *Cane Growers' Quarterly Bull.*, 1971, **34,** 124.—Years ago wireworms were the major pest causing germination failures in sugar cane, until they were controlled by BHC dust mixed with the fertilizer used at planting time. Later BHC dust was replaced by "Lindane". With the recent extended use of high analysis fertilizer mixtures there has arisen a danger that some growers may not be using sufficient insecticide to control the pest properly. Advice to growers in this connexion is given.

* * *

Copper deficiency and droopy top in cane. I. J. V. STEWART. *Cane Growers' Quarterly Bull.*, 1971, **34,** 129–130.—Copper constitutes the major trace element deficiency in Queensland sugar soils and is responsible for the cane malady known as droopy top. Other symptoms that may develop are described. Corrective measures (20–50 lb/acre copper sulphate) are described. With the continual withdrawal of copper by large crops symptoms are beginning to appear on the better soils and not only the sandy soils.

* * *

Salvinia—a rival to water hyacinth? J. F. USHER. *Cane Growers' Quarterly Bull.*, 1971, **34,** 137–138. The presence of this water fern (*Salvinia auriculata*) in the cane areas of Queensland is recorded and growers are urged to eradicate it promptly should it appear on their property. It may be easily spread by spores. Chemical methods of control are discussed.

* * *

Choose the right variety. C. M. MCALEESE. *Cane Growers' Quarterly Bull.*, 1971, **34,** 139–142.—Different varieties are best suited to different conditions, the soil type being a vital factor, while important characteristics are disease resistance and harvesting qualities. The farmer should choose his varieties judiciously to ensure maximum profitability.

Volunteer cane stools are dangerous. B. T. EGAN. *Canegrowers' Quarterly Bull.*, 1971, **34,** 143.—The possibility of volunteer cane stools serving as a reservoir for cane diseases and remaining possible sources of infection, year after year, are discussed. Two concrete examples of such stools harbouring leaf scald disease are given. Cane growers are urged to destroy all volunteer stools.

* * *

Flea beetles—the cause of unusual damage to young cane shoots. I. T. FRESHWATER. *Cane Growers' Quarterly Bull.*, 1971, **34,** 144.—Damage ("shot-hole" perforations) to the young leaves of recently planted cane by flea beetles (family *Chrysomelidae*, sub-family *Halticinae*) is recorded. The infestation did not persist and normal growth was soon resumed.

* * *

Water—blood and life of the sugar cane. R. P. HUMBERT. *Bol. Azuc. Mex.*, 1971, (253), 10–14.—The importance of water to the cane plant is emphasized and the example of Ingenio Tamazula in Mexico quoted, where proper water management has raised cane production sufficiently for an increase of 103% in sugar output. The methods of water application are discussed, as is the quality of water used, and planning of the system.

* * *

Reactions of some Puerto Rican and Hawaiian parental varieties of sugar cane to smut in India. S. SINGH. *Indian Sugar*, 1970, **20,** 673–674.—In 1969 54 Puerto Rican (PR) and 40 Hawaiian (H) varieties were tested for their reaction to cane smut (*Ustilago scitaminea*) with a view to using resistant parents in an endeavour to breed more resistant commercial sugar cane varieties. The results of the study are reported in this paper and summarized in a table.

* * *

On the relative performance of cane varieties in the Ryam area of North Bihar. M. SINGH. *Indian Sugar*, 1970, **20,** 675–678.—The performance of 17 different sugar cane varieties is shown in a table. Varieties BO 60, BO 62, BO 67, BO 70 and BO 72 showed promise. Dependable early varieties are particularly needed.

* * *

Effect of foliar application of maleic hydrazide and terpineol on juice quality of sugar cane. U.S. SINGH, H. A. KHAN and M. M. S. SAXENA. *Indian Sugar*, 1971, **20,** 727–729.—Results are given of experiments carried out to test the possibility of enhancing juice quality by means of foliar spraying with maleic hydrazide and terpineol. The sugar cane variety used was CoS 510. Results showed that neither chemical caused any marked improvement either in the sucrose percentage or the purity coefficient of juice under the conditions prevailing at the Sugarcane Research Station, Shahjahanpur, when sprayed on the plants at fortnightly intervals at concentrations of 250 ppm and 550 ppm.

Studies on the influence of intersown green manure crops on sugar cane. S. JOTHIMOORTHY, R. P. RAJA, T. K. G. RAO and S. D. RAJAN. *Indian Sugar*, 1971, **20,** 731–740.—Results are given of studying the effects of intersown green manure crops, especially sunn hemp and daincha. Intercropping markedly reduced tillering capacity and yield. Juice quality was not affected. A nitrogen saving of about 40 lb/acre was obtained.

* * *

Controlling Johnson grass and Raoul grass on ditch banks in the Louisiana sugar cane areas. ANON. *Sugar Bull.*, 1971, **49,** 214.—Johnson grass on ditch banks can be controlled with foliar applications of either MSMA (monosodium methane arsonate) or "Dalapon". The kind of vegetation that will grow on ditch banks after Johnson grass is controlled will vary with the herbicide used, and may be an important consideration when choosing a herbicide. Bermuda grass will generally invade ditch banks treated with MSMA whereas various broad-leaved weeds and vines will usually invade plots treated with "Dalapon". To control Raoul grass on ditch banks it should be sprayed with MSMA when approximately 2 feet tall and before the seeds mature. Respraying should be done as necessary to control new plants.

* * *

Recommendations for the control of mosaic disease in sugar cane in Louisiana, 1971. ANON. *Sugar Bull.*, 1971, **49,** 216–217.—This disease is present throughout the sugar cane growing area of Louisiana although only traces of infection occur in the northern section of the cane belt. A general account of the disease is given with recommendations for its control, for the benefit of cane growers.

* * *

Borer infestation in the 1970 Louisiana sugar cane crop. L. J. CHARPENTIER, R. D. JACKSON and W. J. MCCORMICK. *Sugar Bull.*, 1971, **49,** 218–219.—The 10% infestation of the 1970 crop by borers is considered light although damage to the crop is estimated at $8·5 million.

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The improvement of sugar cane varieties in Taiwan. S. C. SHIH. *Taiwan Sugar*, 1971, **18,** (1), 5–7.—An interesting account is given of the history of sugar cane varieties in Taiwan. Prior to the establishment of the Experiment Station in 1903 the sugar cane cultivated was the indigenous bamboo cane characterized by slender stalks and low sugar content. This was replaced by the Hawaiian "rose bamboo" and Java-bred POJ varieties. The first locally-bred varieties were established in 1934. After nearly 20 years these, having deteriorated, were replaced by the now famous Natal variety N:Co 310, which dominated the planting acreage for a decade. It is now being replaced by new Taiwan varieties bred from it, such as F 146, F 160 and F 157. An account of these is given. The regional selection and the outlook for further improvement is discussed.

A new method for sugar cane breeding—tissue culture technique. M. C. LIU. *Taiwan Sugar*, 1971, **18,** (1), 8–10.—The development of plant tissue culture, which really started about 1939, is outlined. The first successful culturing of tissue from sugar cane was made in 1962. In 1970 the Taiwan Sugar Experiment Station initiated a research programme in this field, which has proved successful. The culturing of callous tissue with subsequent differentiation of plants for more than 20 clones was successful, resulting in a total of 1650 sugar cane plants being produced. The advantages that the new technique offers in sugar cane breeding are discussed. The various steps involved are outlined, i.e. excision of fleshy tissues, formation of callous tissue, transference and maintenance of callous culture, plantlet differentiation from callous tissue and successful rearing of plants after differentiation.

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New cane varieties released in Taiwan: F 160, F 161, F 162. B. C. MOK and S. LEE. *Taiwan Sugar*, 1971, **18,** (1), 11–14.—Descriptions and agronomic characters are given of these 3 varieties which were bred in Taiwan and now account for 20% of the island's cane crop. F 160 (formerly 59-2331 and bred from N:Co 310) is high yielding. F 161 and F 162 are early. All are adapted to autumn planting and fertile soil. F 162 gives high yields on poorly drained saline soils.

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TSC assists in establishment of sugar industry in Rwanda. J. F. WILLIAMS. *Taiwan Sugar*, 1971, **18,** (1), 15–17.—As part of the aid programme for developing countries, the Taiwan Sugar Corporation has recently assisted in the establishment of the fledgling sugar industry in the Republic of Rwanda in Africa (formerly the Belgian trust territory of Ruanda-Urundi). The country is smaller than Taiwan, approx. 10,000 square miles as against Taiwan's 14,000, and the population $3\frac{1}{2}$ million as against Taiwan's 15 million. A cultivation system similar to that of Taiwan has been adopted. Rainfall is more adequate and the soil quite fertile, no irrigation or fertilization being initially required. Harvesting is carried out with a combination of labourers, trucks and tractors. Present cane varieties include the Taiwan F 143 and Pindar. Yields have been good, 116 tons/ha. The mill constructed is small (60 tons cane per day). Seven Chinese technicians assist in the project.

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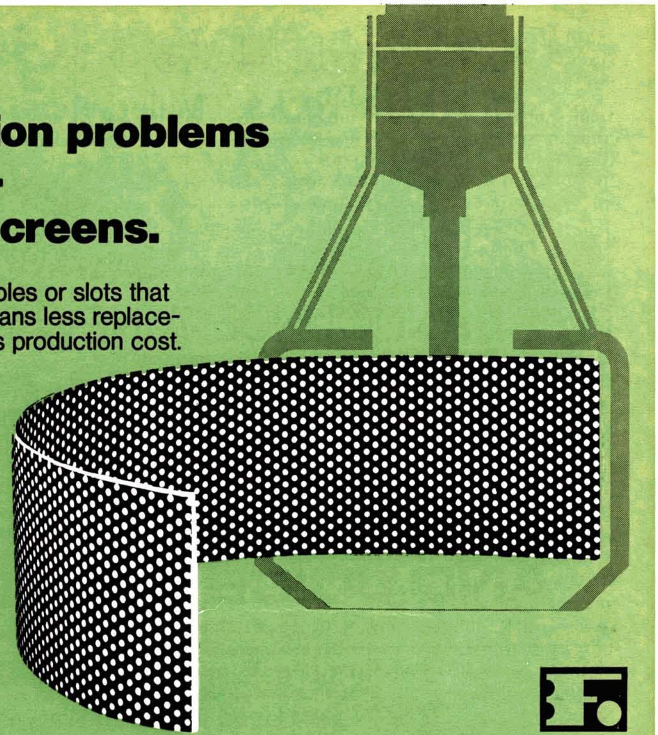
Florida sugar cane growers host harvesting field day. ANON. *Sugar y Azúcar*, 1971, **66,** (6), 26–27.—Cane harvesters at work at the Fifth Annual Sugar Harvesting Field Day are briefly described and illustrated with photographs. They operated on plantations in and around Belle Glade, Florida. Agronomists from various sugar cane growing countries were present. The machines demonstrated included the Toft CH 364 and J150 harvesters from Australia, J and L two-row recumbent cane harvester, U.S.



Sugar Corporation's and the Cary one-row recumbent harvesters and the Thomson "Duncaña" harvester.

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The tuza, a cane pest. A. VELASCO P. *Bol. Azuc. Mex.*, 1971, (254), 6–7.—The rodent (*Geomys mexicana*) is most prevalent in the central part of the State of Veracruz and occurs also in Jalisco, Michoacán, Tabasco and Campeche. Methods of combating the pest are outlined, such as trapping, gassing and poisoning.

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The consumption of fertilizers in Mexico in recent decades. H. MARTÍNEZ M. *Bol. Azuc. Mex.*, 1971, (254), 8–11.—The consumption of fertilizers in Mexico has rocketed in recent years, having been 603,000 tons in 1970 as against 165,000 tons in 1960, and only 8000 tons in 1950. Mexico is responsible for 50% of the total chemical fertilizer production for Latin America, using about half of her production domestically.

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Notes on the large-scale making of artificial manure in Argentina. F. ZENDY-ZUCKER. *Bol. Azuc. Mex.*, 1971, (254), 16–22.—Materials used as substitutes for animal manure are discussed and a list showing nitrogen and phosphorus content of a wide range of common agricultural products or by-products is given.

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A co-ordinated approach to yield problems in a co-operative mill area. O. W. STURGESS and G. M. RYDER. *Proc. 38th Conf. Queensland Soc. Sugar Cane Tech.*, 1971, 37–40.—In the Babinda Mill area low sugar content in juice has been a recurring and puzzling problem for many years. Local environment has been suggested as a cause but more concrete information is needed and a committee has been appointed to investigate the problem. Its composition and function are discussed.

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Predicting rainfall erosion losses in sugar cane lands. H. D. FRANKS and G. L. SWARTZ. *Proc. 38th Conf. Queensland Soc. Sugar Cane Tech.*, 1971, 41–46.—In Queensland sugar cane areas soil erosion may take the form of gullying or sheet erosion. It is a continuing process and its spectacular ravages are easily observed but a blind eye is often turned to less dramatic soil loss. Over a long period fertility may be considerably reduced. To tackle this problem the idea of predicting soil loss and establishing soil loss tolerance is proposed. This approach, which has been developed in the United States, is explained in this paper. It is being applied by the Soil Conservation Service of Queensland. A discussion of the preliminary attempt to adapt American data to Queensland sugar cane areas is followed by an example of the sort of predictions that can be made. The paper ends with a discussion of the investigations required to provide accurate predictions with confidence.

Fertilizer economy. R. B. MOLLER. *Proc. 38th Conf. Queensland Soc. Sugar Cane Tech.*, 1971, 47–49.—Of recent years cane farmers have been confronted with new fertilizers, new handling concepts, application techniques and procedures. This paper looks at the ability of the average Queensland farmer to adapt these changes for his own economic advantage. Not more than one in three cane growers makes use of available soil testing facilities. Even fewer use these facilities adequately. Methods of determining units of fertilizer in mixtures, and their relative costs, are not well understood. Fertilizer distribution problems exist. Consequently cane growers are not making the best use of recent advances in fertilizer technology.

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Arrow suppression trials with N:Co 310 in the Mackay district. K. C. LEVERINGTON, C. L. TOOHEY and A. C. ARVIER. *Proc. 38th Conf. Queensland Soc. Sugar Cane Tech.*, 1971, 51–58.—Further trials with "Diquat", sprayed from the air and from the ground to inhibit flowering, are recorded. Quite low concentrations (0·5 and 1·5 oz. "Diquat" ion per acre) were effective in suppressing flowering but unfortunately adversely affected yield and sugar content. It was concluded that in the Mackay area the use of "Diquat" for the suppression of flowering would not be economical if carried out commercially.

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The effect of limited investment funds on the nitrogen, phosphorus and potassium recommendations for sugar cane. L. S. CHAPMAN. *Proc. 38th Conf. Queensland Soc. Sugar Cane Tech.*, 1971, 59–68.—Earlier N-P-K field experiments were used to forecast fertilizer application rates to produce maximum returns. When the investment in fertilizer for maximum returns was reduced so that there was an equal marginal net return on each of N, P and K, then the N-P-K ratio for any soil fertility situation was altered. The levels of K recommended under limited investment funds were reduced irrespective of soil fertility levels and the P levels recommended were reduced under high P soil levels. The effect of limited investment funds on N levels were less than the effects on P levels, which were less than the effects on K levels.

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The estimation of potassium availability in Mackay soils. M. B. C. HAYSOM. *Proc. 30th Conf. Queensland Soc. Sugar Cane Tech.*, 1971, 113–119.—It is known that with sugar cane soils, for a given level of exchangeable K some soils exhibit a greater crop response to K than do others, even under similar climatic conditions. The object of this paper is to outline the development of a method which measures part of the non-exchangeable soil K together with the exchangeable form of the soil K to the extent that the total level so measured leads to a better correlation, on the single value basis, with crop response. It is expected that this method will be adopted on a routine basis for the fertilizer advisory service operating in the Mackay district in future years.

Sugar beet agriculture

Investigations on the effect of root-invading fungi on development, yield and quality of sugar beet. G. Bartels and C. Winner. *Zucker*, 1971, **24,** 315–321, 352–355.—Results are given of experiments carried out during two seasons in which an attempt was made to estimate the effect of feeding-root decay on development, yield and quality of sugar beets. It was found that pot trials did not afford a good criterion of what may take place in the field. The invasion of the feeding-roots by soil-inhabiting fungi (*Phycomycetes*, *Aphanomycetes* and species of *Pythium*) persistently impaired development and yield. Non-biotic factors, such as soil moisture, soil structure and nutrient supply, also influenced the amount of root damage.

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Damping-off of sugar beets caused by ***Aphanomyces cochlioides*** **as affected by soil amendments and chemicals in the greenhouse.** J. A. Lewis and G. C. Papavizas. *Plant Disease Reporter*, 1971, **55,** 440–444. Of various non-volatile fungicides tried to reduce damping-off of sugar beet seedlings in the greenhouse due to the fungus *Aphanomyces cochlioides*, only "Dex" (Na *p*-dimethylaminobenzene diazosulphonate), at 100 ppm, was effective. Urea and NH_4OH were as effective as "Dex" and did not have any long-lasting effect on the soil. All plant tissue amendments, except for corn, incorporated into soil, statistically reduced both pre- and post-emergence damping-off. Of the effective amendments, eight were members of the family *Cruciferae*.

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Control of ***Cercospora*** **leaf spot of sugar beet under sprinkler irrigation.** A. O. Paulus *et al. Plant Disease Reporter*, 1971, **55,** 449–452.—This disease (*Cercospora beticola*) was not of economic importance in the Riverside-Helmet area of California when sugar beet fields were furrow irrigated, but when growers turned to sprinkler irrigation, medium to severe epidemics of the disease took place. "Benomyl" was significantly better than all other materials tested for control when applied by ground or aerial application or on a 10-, 18-, or 21-day spray schedule.

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Trials of commercial varieties of sugar beet. L. A. Willey. *British Sugar Beet Rev.*, 1971, 39, 165–168. In 1970 there were 20 commercial trials in England compared with 14 in 1969. These are discussed and information given in tables. The varieties concerned include Bush Munro, Sharpe's Klein E, Amono, Anglo-Maribo Poly, Hilleshog Monotri, Sharpe's Klein Polybeet, Sharp's Klein Monobeet, Sharp's Megapoly. Growers are also referred to articles published previously and to Farmers' Leaflet No. 5, "Varieties of Sugar Beet", published by the UK National Institute of Agricultural Botany.

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Precision drills at work. Anon. *British Sugar Beet Rev.*, 1971, **39,** 169–172.—Plots were sown at Witham, Essex, England on 25th March at three different speeds by precision drills, the plots being available for inspection later (27th May). The different makes of precision drill are illustrated with photographs which include a Monocentra 6-speed central drive seeder, Stayhay S 766 4-speed master land wheel unit and Webb and Monodrill wheel drive units.

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Mangold clamps and virus yellows. G. D. Heathcote. *British Sugar Beet Rev.*, 1971, **39,** 173–174.—The danger to the sugar beet crop of clamped mangolds left unused in late spring is stressed, for such clamps may breed aphids that become a source of virus yellows for sugar beet. The roots from such clamps should be fed to livestock before the end of April. Results of a mangold clamp survey are given. This showed the number of infected clamps to be low. The mangold acreage in England is steadily declining.

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Yorkshire grower's investment cuts haulage costs. M. Webster. *British Sugar Beet Rev.*, 1971, **39,** 175–176.—The many advantages of a concrete base (or bases), strategically placed, on a sugar beet farm is discussed. It can be used for the storage of other materials and may be cheaply constructed using farm labour at a slack period. The main advantage to the beet grower is that it ensures cleaner beet and reduces the quantity of soil carried to the factory with a saving in transport costs. At the same time the cleaner- and tractor-loader can operate more efficiently, particularly under difficult weather conditions. Wear and tear of equipment is minimized. Losses due to burying and breakage are reduced and the removal of waste soil simplified.

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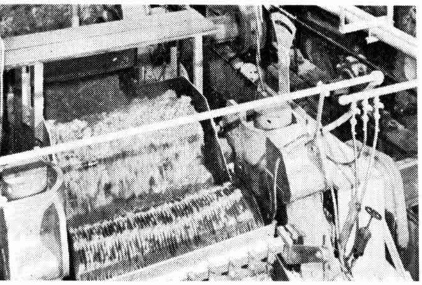
Handle herbicides with care. Anon. *Sugar Beet J.*, 1971, **34,** (3), 17–18.—Herbicides are normally safe to use if properly handled, but the skin and eyes may need protection or safe-guarding. The correct methods of working with herbicides or pesticides, involving the use of gloves, are illustrated with photographs.



Cane sugar manufacture

Reduction of cane cleaner losses at Laupahoehoe Sugar Company. J. Bouvet. *Rpts.* 1970 *Meeting Hawaiian Sugar Tech.*, 16–22.—Problems encountered with a cane wet-cleaner at Ookala sugar factory are reported and tests with a dry-cleaner mentioned. Despite some reduction in cleaner losses, from 14% recoverable pol in cane in 1968 to 11% in 1970, economic considerations dictate that there should be further improvements, and suggested modifications to the wet-cleaner, incorporating some of the elements of the dry-cleaner, are listed.

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Mill automation at Laupahoehoe Sugar Company. J. Bouvet. *Rpts.* 1970 *Meeting Hawaiian Sugar Tech.*, 23–25.—Details are given of a semi-automatic control system of the "on-off" type in which the crusher speed is manually set to correspond to a desired milling rate and the speed of each of the four mills adjusted to a value slightly below that necessary for the given fibre throughput. Because of the low settings, the bagasse level in each of the Donnelly feed chutes rises to a pre-determined height, at which each mill will automatically raise its speed by a pre-set amount so as to bring the bagasse down to the required level. Simple provision is made for bypassing of the chute by bagasse when the level in the chute rises as a result of slippage and rises still further when the mill speed increases.

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Hydraulic controls for mill crane. G. Fernandes. *Rpts.* 1970 *Meeting Hawaiian Sugar Tech.*, 47–52. Details are given of a hydraulic control system installed in a mill yard crane at the author's sugar factory to alleviate crane driver fatigue. The costs are lower than those of a more sophisticated system, although the scheme used has operated fairly satisfactorily, and are considerably lower than of a standard pneumatic control system.

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The Honiron "Hi-Extractor" installed at Honokaa Sugar Company. J. W. Bersch. *Rpts.* 1970 *Meeting Hawaiian Sugar Tech.*, 84–87.—Details are given of the Honiron "Hi-Extractor" cane diffuser[1] installed between the 4th and 5th mills at Honokaa. At a low grinding rate of 100–115 tch and a temperature of 140–150°F the "Hi-Extractor" multi-press reduced bagasse moisture to 52·5–57·5% in a one-day test. Bagasse moisture was further reduced to 48–49% in the 5th mill which gave a final bagasse pol content of 1·16–1·29% at a throughput of 32–37 tons/hr. The extraction was some 2% higher than in the milling tandem at the same factory. Maintenance costs of the "Hi-Extractor" are expected to be only 15–20% of those of a mill.

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Comparisons of burning *vs.* non-burning of cane. II. Factory—refinability. J. C. Tu. *Rpts.* 1970 *Meeting Hawaiian Sugar Tech.*, 111–115.—Comparative tests are reported in which juice from burnt and unburnt cane was processed at three sugar factories. Results indicated that in terms of mixed juice, clarified juice and syrup refractometric solids, colour and viscosity and *A*-sugar colour, filtrability, small grain content and pol, the burnt cane yielded a better juice than did the unburnt cane.

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Honiron "Hi-Extractor" performance. L. J. Rhodes. *Ann. Rpt. Hawaiian Sugar Planters' Assoc. Expt. Sta.*, 1970, 128–129.—Further experimental performance data are given for the "Hi-Extractor" cane diffuser. Compared with milling, sugar extraction and recovery were 2% higher, bagasse pol and fibre contents 0·6% absolute and 1·3% absolute lower, and bagasse moisture 2·1% absolute higher. Mixed juice purity and insoluble solids content were basically the same as with milling. Juice retention in the "Hi-Extractor" averaged 20 min at normal rates, although about 75 min was required for complete juice throughput. No appreciable juice deterioration took place after 90 min at 65°C, which is approximately the temperature in the "Hi-Extractor" process.

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Extraction mechanism in porous beds. E. J. Lui. *Ann. Rpt. Hawaiian Sugar Planters' Assoc. Expt. Sta.*, 1970, 129.—From experiments with salt extraction from bagasse, a mathematical model has been developed which separates the two transport mechanisms found to be involved in cane diffusion: (1) displacement, by which most of the solute is removed, and (ii) molecular diffusion, which is the slower process and governs the degree of extraction. The data are to be used in future work on sucrose extraction from cane.

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Simulation of ring diffuser dynamics. E. J. Lui. *Ann. Rpt. Hawaiian Sugar Planters' Assoc. Expt. Sta.*, 1970, 129–130.—Digital-analogue simulation data compared favourably with true intermixing patterns observed in the Silver ring diffuser at Pioneer after injection of KCl solution under juice distributor 9

[1] *I.S.J.*, 1969, **71**, 116, 348.

and determination of its concentration at distributors 10 and 11. However, discrepancies occurred between the times for the individual pulses and are attributed to channelling. Nevertheless, each stage in the diffuser can be adequately represented by a second-order differential equation plus an allowance for transport delay.

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Press-juice handling. G. E. SLOANE, K. M. ONNA and E. J. LUI. *Ann. Rpt. Hawaiian Sugar Planters' Assoc. Expt. Sta.*, 1970, 130–131.—Tests were conducted on vacuum filtration, using a pilot-scale filter, of a combination of underflows from a diffuser raw juice clarifier and a pressed juice clarifier. For good filter cake pick-up, control of the total insoluble solids in the two underflows and in the filter feed proved necessary, and a high insoluble solids content (8–10%) was better for pick-up than was a low content (3%). A higher insoluble solids content also gave lower pol in raw juice clarifier underflow. If the filtrate from the combined underflow is returned to the press juice clarifier, the pol in the overflow from this clarifier, which is sent to diffusion, will rise and diffuser extraction fall (by about 0·2% when the insoluble solids level in the raw juice clarifier underflow is high). This reduction can be avoided by returning the filtrate to the diffuser separately, although then 70–80% more non-fibrous insoluble solids will be recycled to diffusion than with return of the filtrate to the press juice clarifier.

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New flocculants show promise in juice clarification. K. M. ONNA and G. E. SLOANE. *Ann. Rpt. Hawaiian Sugar Planters' Assoc. Expt. Sta.*, 1970, 131–132.—In laboratory-scale tests on mixed juice and, to a lesser extent, press juice and filtrate from the ring diffuser at Pioneer, "Magnifloc 835A" and "Magnifloc 836A" (manufactured by American Cyanamid Co.) gave better results than did "Separan AP-30", while "Magnifloc 837A" and "Magnifloc 905N" gave about the same improvement in clarification as did "Separan AP-30".

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Double purging of low-grade massecuite—laboratory studies. T. MORITSUGU. *Ann. Rpt. Hawaiian Sugar Planters' Assoc. Expt. Sta.*, 1970, 134–135.—The refining properties of recrystallized, double-purged low-grade sugar were compared with those of the same sugar after recrystallization but omitting double-purging. *A*- and *B*-molasses was used for mingling with the low-grade sugar, the purity of which was increased from 78–86 to 92–96 by the double-purging, which removed 55–75% of the impurities from the sugar crystal surfaces. *A*-molasses proved preferable to *B*-molasses for purging, since the latter's purity was reduced to too low a level for use in boiling *C*-strikes. An additional 30% centrifugal capacity was also required when double-purging with *B*-molasses, compared with single-purging, only 20% additional capacity being necessary with *A*-molasses. Sugar recrystallized from double-purged low-grade sugar solution of 93·4 purity had a lower colour and slightly better filtrability than did sugar recrystallized from the same solution not subject to double-purging. It is emphasized that the improvement brought about by double-purging on a factory scale would not be as great as on a laboratory scale.

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Rock removal for dry-cleaners. D. K. LEWIS. *Ann. Rpt. Hawaiian Sugar Planters' Assoc. Expt. Sta.*, 1970, 136–137.—A mathematical model simulating a rock removal system using high-velocity air has been developed for digital computer analysis, and the effects of air flow, nozzle placement, and splitter location have been studied to find the optimum combination of these variables for application with a cane dry-cleaner. Experimentally determined values of the aerodynamic properties of rocks and cane stalks were used in the model.

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Factory processing in relation to refinability. G. E. SLOANE, J. C. TU and T. MORITSUGU. *Ann. Rpt. Hawaiian Sugar Planters' Assoc. Expt. Sta.*, 1970, 139–140.—Analyses of juices, evaporator thick juice, sugar and molasses showed no consistent relationship between juice and syrup colour on the one hand and the colour of the sugar crystal on the other. However, crystal colour was highly correlated with massecuite purity, the difference between massecuite and molasses purities and the hexose polysaccharide content of the mixed juice. Filtrability was related to the water-insoluble and methanol-insoluble solids in syrup.

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Refinability tests at H.C. & S. G. E. SLOANE, J. C. TU and T. MORITSUGU. *Ann. Rpt. Hawaiian Sugar Planters' Assoc. Expt. Sta.*, 1970, 140–141.—While many differences were found between processing results (including low-grade boiling) at two similar sugar factories handling cane from the same field and using the same factory procedures, no differences were found in exhaustibility of the molasses at the two factories nor in the *B*-molasses crystallization rates.

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Polyelectrolyte treatment of cane cleaner waste water. K. M. ONNA and G. E. SLOANE. *Ann. Rpt. Hawaiian Sugar Planters' Assoc. Expt. Sta.*, 1970, 151.—Although six polyelectrolytes out of a number tested proved effective, at varying levels in the range 0·25–5 ppm, in the treatment of cane cleaner effluent, full-scale treatment would be costly and the polyelectrolytes are recommended only on a standby basis.

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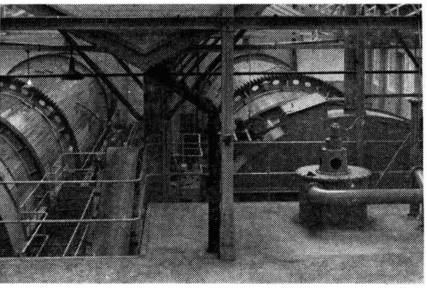
The Venezuela sugar industry. F. CORDOVEZ. *Sugar J.*, 1971, **34,** (2), 31.—A brief survey is presented of the Venezuelan cane sugar industry, with information on the factories/refineries and syrup mills and mention of some of the equipment used.



Beet sugar manufacture

New ideas and constructions in the beet sugar industry. A. C. PLOUVIER. *Hautes Etudes Betterav. Agric.*, 1971, **3,** (10), 14–23.—The author is Projects Director for the Venot-Pic company and he describes projects of his company which have resulted in recent years from the application of experience in other industries to problems of the sugar factory. They include dry beet storage, beet washing in drums, stone removal, etc., and installations in French sugar factories are described and illustrated.

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Optimization of the distribution of quantities of beet in the sugar factories. R. GIBON. *Sucr. Belge.*, 1971, **90,** 263–268.—The author considers the application of operational research to optimization of distribution of beet quantities among the different factories of S.A. Raffinerie Tirlemontoise which owns, on the one hand, sugar factories scattered throughout Belgium which produce ordinary crystal sugar, 1st or 2nd raw sugars, 2nd green syrup and molasses, and, on the other hand, a central establishment at Tirlemont which comprises a sugar factory and a refinery processing the half-finished products from the sugar factories.

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Control of sucrose loss in sugar beet during storage by chemicals and modified atmosphere and certain associated physiological changes. M. T. WU, B. SINGH, J. C. THEURER, L. E. OLSON and D. K. SALUNKHE. *J. Amer. Soc. Sugar Beet Tech.*, 1970, **16,** 117–127. Reduced sucrose loss, reduced raffinose concentration and reduced respiration rate in stored beets were achieved by pre-harvest spraying with "Randox" (α-chloro-N,N-diallyl acetamide), post-harvest dipping in N^6-benzyladenine and modification of the atmosphere of beet storage to high CO_2 and low O_2 content. Sucrose content was reduced by pre-harvest spraying with N^6-benzyladenine mixed with indole acetic acid, "Chloro-IPC" [*iso*-propyl-N-(3-chlorophenyl) carbamate], sodium hexametaphosphate, or "Telone" while other treatments had no significant effects on the root sucrose content, compared with untreated controls.

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A method of evaluating the processing characteristics of sugar beets, based on juice constituents: a prescription of beet quality. S. T. DEXTER, M. G. FRAKES and R. E. WYSE. *J. Amer. Soc. Sugar Beet Tech.*, 1970, **16,** 128–135.—Changes in juice constituents were determined after storage at 2° and 8°C; invert sugar content rose, especially at 8°C, and the effect of topping was insignificant compared with storage. Relatively little change occurred in (K + Na — amino-N). Acid formation by invert sugar decomposition was much greater at 8° than at 2°C, and molasses loss resulting from the soda ash needed to raise the consequent juice pH is estimated at 19 and 8 lb extractable sugar per ton of beet, respectively. For beet breeding, no increase of invert sugar in storage and processing quality after storage are important characteristics.

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The direct production of liquid sugar from ion exchange treated thick juice. L. T. ZANTO and S. E. BICHSEL. *J. Amer. Soc. Sugar Beet Tech.*, 1970, **16,** 149–155. Ion exchange treatment is used to convert thick juice of 30°Bx to a liquid sugar of 94–100 solution grade (colour-turbidity) with complete elimination of floc, nitrogen, Na, K and Cl and with an invert content of 1·46% which can be reduced to 0·70% by more complete invert destruction in carbonatation. Whether the process would be commercially practical depends on resin stability and fouling, regenerant usage, etc., and the year-round market for the product must be established.

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Physico-chemical and microbiological studies on controlled atmosphere storage of sugar beets. V. V. KARNIK, D. K. SALUNKHE, L. E. OLSON and F. J. POST. *J. Amer. Soc. Sugar Beet Tech.*, 1970, **16,** 156–167.—Beets were subjected to storage for up to 200 days in controlled atmospheres in which the CO_2 contents were enhanced and the oxygen contents lowered. In all cases the sucrose content was retained more than in a natural atmosphere, irrespective of temperature, and the maximum beneficial effects were found at 6% CO_2 and 5% O_2 at 35°F. Other beneficial effects included less inversion and control of raffinose accumulation. Fungal growth and sprouting were also inhibited significantly.

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Losses in wet piling of beet at Opava. J. ZAHRADNÍČEK, L. VOKOUNOVÁ and J. HORÁKOVÁ. *Listy Cukr.*, 1971, **87,** 104–108.—Determinations of beet losses at Opava sugar factory (Czechoslovakia), where an Elfa wet piling system is used, showed that the greatest mechanical damage was incurred by beet falling from the water chute onto the pile, while the next highest losses through mechanical damage occurred when the beet were transferred from the pile to the flumes by means of water jets. Daily sugar losses in the stored beet were higher than the national average;

this is attributed to the high proportion of damaged beet which became quickly infected, the process being aggravated by the contaminated water used for the wet piling.

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Production of high-quality fine-grade crystal directly from thick juice. A. KOVAŘÍK, K. ČÍŽ and V. ČEJKOVÁ. *Listy Cukr.*, 1971, **87**, 114–116.—Tests at Prelouc demonstrated the possibility of using the process previously described[1] to produce fine-grade white sugar crystal averaging 0·78 mm in size. Comparison of the scheme with the original system, in which the 1st massecuite is cured to produce normal crystal, showed that the ash content of the fine crystal was 79% lower at 0·021% and the colour 82·4% lower at 0·18°St. The fine crystal was of Grade 2 compared with 5–6, and the molasses content was 0·163% (found polarographically) compared with 0·360%.

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The thyristor and its application in modern drives. L. BALÁZS. *Cukoripar*, 1971, **24**, 63–68.—The static and dynamic properties of junction diodes, transistors, dynistors and thyristors are examined and their possible applications for automatic control of electric drives discussed.

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Determination of iron by atomic absorption as a means of detecting corrosion in sugar factory evaporators. R. PIECK and J. HOUSSIAU. *Sucr. Belge*, 1971, **90**, 397–405.—See *I.S.J.*, 1972, **74**, 116.

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Test on an experimental factory-scale FiLS filter-thickener station. YU. F. TSYUKALO. *Sakhar. Prom.*, 1971, **45**, (6), 15–20.—Details are given of experimental operation of a fully-automatic battery of six FiLS filter-thickeners (similar in design to the Grand-Pont unit) throughout the 1970/71 campaign in the USSR. Although the throughput of the filters was below requirements (attributed to elimination of juice recycling to pre-liming), they are recommended for replacement of settlers for 1st carbonatation juice treatment. Turbidity of the filtrate was 0·3–0·6 g/litre and mud density 1·19–1·21 g/cm³, compared with a density of 1·15–1·16 g/cm³ for mud from gravity settlers. At a filtration surface of 36 m², throughput per filter corresponded to the juice from 360 tons of beet/day.

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Unused potentials of continuous diffusion. A. I. VOSTOKOV and I. P. LEPESHKIN. *Sakhar. Prom.*, 1971, **45**, (6), 20–24.—The opportunity to bring about reductions in labour, losses and juice draft through introduction of continuous diffusion in the USSR has not been seized, according to the authors. The chief reasons for failure to improve on battery diffuser performance in continuous diffusers are given as excessive cossette thickness and unsuitable juice: cossette ratios. Details are given of a continuous diffuser design, patented by the authors about 12 years ago, which consists of two linked towers fed individually with cossettes which fall under gravity against a rising current of water introduced after removal of each charge of exhausted cossettes. The water pushes juice ahead of it until the latter reaches the collector towards the top of the tower, whence it is pumped to preliming. Juice and feed water tanks and the valve and mixer for exhausted cossettes are common to the two towers.

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Production of continuous centrifugal screens at "Sakhavtomat" factory. N. A. NEDYAK, E. N. ZUBOK, A. N. DAVIDENKO and Z. D. BELIK. *Sakhar. Prom.*, 1971, **45**, (6), 25.—Details are given of Soviet non-woven nickel steel screens which have been tested on a number of imported centrifugals and given satisfactory results.

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Mathematical method for determining the dry solids content of high-purity massecuites. T. P. KHVALKOVSKII. *Sakhar. Prom.*, 1971, **45**, (6), 26–28.—A table is presented from which massecuite dry solids can be found, given massecuite sugar content and run-off dry solids and sugar content. The method is based on earlier formulae for low-grade massecuite[2] and applies to massecuite purities of at least 86.

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Phosphatation of boiler feed water with sodium hexametaphosphate. P. G. ZAGOROVSKII. *Sakhar. Prom.*, 1971, **45**, (6), 31–32.—Tests over a number of years have shown that treatment of boiler feed water with sodium hexametaphosphate instead of sodium triphosphate reduces the rate of deposition of iron oxides on boiler tubes. However, since hexametaphosphate reduces alkalinity through formation of monophosphate, when the alkalinity is below requirement the hexametaphosphate should be added together with NaOH or triphosphate.

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Continuous traps for stones, gravel and sand. W. ORZESZKO. *Gaz. Cukr.*, 1971, **79**, 106–112.—Descriptions are given of a stone and gravel trap and of a sand trap, both designed by Cukroprojekt. In the former trap, a current of water is sent up into a section of the beet flume, causing turbulence and the stones and coarse gravel to sink onto a continuous rake conveyor; in the latter the sand and fine gravel fall through a grating, but no rising water current is used.

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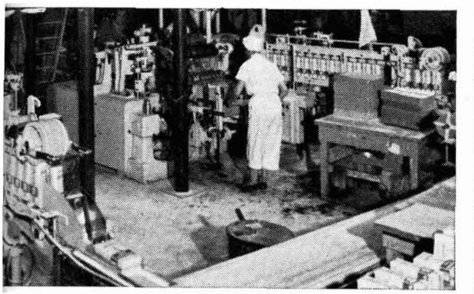
A DDS diffuser at Sárvár sugar factory. A. BUCZOLICH. *Cukoripar*, 1971, **24**, 85–90.—Details and some performance data are given of a DDS continuous beet diffuser installed in 1969 by CEKOP at Sárvár factory in Hungary. At an average throughput of 2400 tons of beet/day and a juice draft of 115% losses were 0·25–0·35%.

[1] BURIÁNEK: *I.S.J.*, 1969, **71**, 278.
[2] KHVALKOVSKII: *ibid.*, 1970, **72**, 372.



Sugar refining

Addition of starch to powdered sugar. K. Číž, M. Rohlík and V. Čejková. *Listy Cukr.*, 1971, **87**, 109–113.—Addition of 2% starch to powdered sugar stored at 20–25°C and 55–65% relative humidity prevented caking and lumping. The effects of variations in storage conditions on the quantity of starch needed to prevent caking were studied, from which it is recommended that the quantity required be found in accordance with the storage conditions at individual plants. Addition of starch caused a slight increase in the numbers of thermophiles, yeasts and moulds infecting stored sugar, but the mesophile count was reduced.

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Counter-current ion exchange unit for syrup decolorization. A. A. Ivanyuk *et al. Sakhar. Prom.*, 1971, **45,** (6), 6–11.—Three series of syrup decolorizing tests are reported in which anion exchange resin was used in counter-current treatment. Results for 90–91 purity syrup of 16–18°St colour (decolorizing efficiency of 46–49%) were little different from those for 82–85 purity syrup of 58–88°St colour (37–50%), while 64% decolorization was achieved with a syrup of 91 purity and 44°St colour. Syrup pH and purity rose slightly with resin treatment. Regeneration of the resin gave a decolorizing efficiency 67–74% of that of the original fresh resin. Treatment with HCl gave greater sorptive properties than did NaOH treatment.

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Decolorization of raw sugar by activated carbon. W. D. Person and J. T. Truemper. *Sugar J.*, 1971, **34,** (1), 9–13.—Tests were carried out at Atlas Chemical Industries Ltd. in which washed raw sugar samples from various sources were decolorized with the three basic commercial activated carbons manufactured by Atlas. After failure to find a representative sample which could be used to evaluate experimental carbons, even using a standard carbon, a composite sugar was made up from five samples for which the decolorizing efficiencies of the carbons came close to the overall averages. The results for the composite were sufficiently close to the overall averages to justify use of a composite. From unsatisfactory results of storage of one or two samples for 1 year, it is concluded that the reference sample should be made from fresh sugar.

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Effect of ionic form on the decolorizing capacity of AV-16GS anion exchange resin. M. V. Rozhkova and G. A. Chikin. *Sakhar. Prom.*, 1971, **45,** (7), 13–17.—Tests are reported aimed at finding the most suitable form of AV-16GS anion exchange resin which is amphoteric and hence has the properties of a weakly basic anion exchange resin and a weakly acid cation exchanger. Of the two forms used to decolorize sugar solutions, the more effective was the H^+-Cl^- form, followed by the Na^+-OH^- form. However, to avoid acidification of the treated solution and give a practically neutral eluate, the resin should be regenerated with 0·5N NaOH followed by 0·1N HCl at the rate of 0·5 equiv./equiv. cation exchange capacity. Decolorization efficiencies exceeding 90% were achieved with 25 volumes/volume of resin using this means of regeneration.

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Prospects for liquid sugars in the food industry and the "Reggiane L.S." process. P. Baldassari. *Ind. Alimentari*, 1971, **10,** (7), 88–94.—The author surveys the growth of the market for liquid sugars in various countries of the world and discusses the advantages of the product. He then describes without detail the patented "Reggiane L.S." process for liquid sugar manufacture; an impure sugar solution is filtered and passed through four resin beds in series which remove mineral content and colour. The solution is then heated, concentrated and the resulting syrup cooled.

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The sugar refinery at Ingenio El Potrero, Mexico. Anon. *Sugar y Azúcar*, 1971, **66,** (7), 30–31.—Information is given on processes and equipment used at Ingenio El Potrero, in Mexico, which produces 1500 tons of refined sugar a day.

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Materials balance in a refinery in the off-season period. P. M. Fabregat P. and R. Espinosa P. *Bol. Ofic. A.T.A.C.*, 1971, 33–53.—The calculation of a solids balance in a refinery is illustrated, using purity, Brix and moisture contents of the various materials entering the process: raw sugar, affination syrup and magma, raw liquor, *A*-, *B*- and *C*-refined massecuites, etc.

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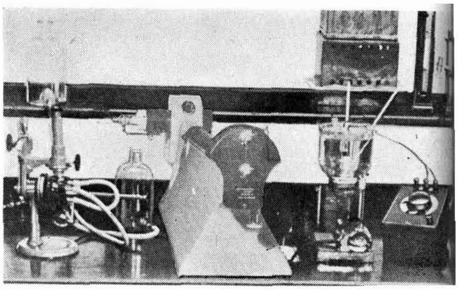
Pollution problems and regulations for burning. Anon. *Sugar J.*, 1971, **34,** (4), 31.—How regulations in Canada and the USA concerning air and water pollution affect sugar refineries and factories is discussed and methods used to meet the requirements are outlined.

Laboratory methods & Chemical reports



Determination of pectins in beet and raw juice by a colorimetric method. J. OČENÁŠKOVÁ and M. FRIML. *Listy Cukr.*, 1971, **87**, 87–91.—The method described is based on measurement of the colour evolved when galacturonic acid, the principal constituent of pectic acid, reacts with carbazole in the presence of conc. sulphuric acid. Although pectin contains up to about 30% arabinose, which also reacts with carbazole, interference is low because of the much smaller absorbancy of arabinose, which is about one-sixth that of galacturonic acid, and the effect of arabinose can be ignored for normal analytical purposes. Extraction with aluminium chloride was found preferable to alcohol extraction, and extraction time and temperature were decisive for colour intensity. Optimum extraction time was 7 min, and the optimum temperature was the highest that could be easily reproduced on a hot water bath. Details are given of the procedures for pectin determination in raw juice and beet. The ratio of soluble pectin hydrate to insoluble protopectin in beet was found to be 0·18–1·18.

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Effect of non-sugars on change in pH and pOH of sugar solutions at different temperatures. V. A. PRONINA and S. V. IVANOV. *Sakhar. Prom.*, 1971, **45,** (5), 10–13.—Experimental studies showed that although aqueous solutions of specific non-sugars (0·1 mol/litre) normally encountered in beet sugar manufacture underwent changes in pH and pOH with rise in temperature from 20° to 95°C according to the non-sugar, when 1 mol/litre of sucrose was added the change in pH and pOH with temperature rise was of the same absolute order as without sucrose. The greatest pH change was found with alkaline solutions and was smallest with acid and neutral solutions, while the reverse was true for pOH change.

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Determination of the mean size of massecuite crystals. M. I. DAISHEV, N. A. LYSYI and I. N. AKINDINOV. *Sakhar. Prom.*, 1971, **45,** (5), 13–16.—Existing methods of determining crystal size are found to be unsatisfactory for reasons stated, and a proposed method is described which is based on the relationship between the volume of molasses on the crystal surfaces and a dimensionless relation describing the basic factors involved in centrifugalling. After centrifuging the massecuite sample at constant speed for a given time, the various parameters required are determined and the values substituted in a formula developed for crystal size calculation as the linear dimension of a cube. Reasonable close agreement was found between calculated and experimental values.

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Determination of sucrose content in beet and beet cossettes. A. YA. ZAGORUL'KO and A. A. PONOMARENKO. *Sakhar. Prom.*, 1971, **45,** (5), 24–28.—Of a number of methods for determining beet and cossette sucrose, the only one giving the same value as the control (gravimetric) method with fresh beet was that in which 52 g of beet brei, obtained during 6 min with simultaneous cooling, was extracted with 356·4 cm^2 of 80% ethyl alcohol and treated with 2·4 g clarifying agent. However, differences occurred with variation in beet quality. A proposed method was tested, in which the sugar content (C_o) is given by $C_o' — \Delta C_o — \Delta P$, where C_o' is the direct polarization, ΔC_o is the difference between the value given by hot or cold water digestion and the polarization of the filtrate from alcohol extraction, and ΔP is the content of optically-active matter decomposed by lime[1]. The values given by this method coincided with those given by the gravimetric method for both fresh and stale beet.

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Investigation of the electrical conductance of pulp press water, juices and syrups by a contactless conductimetry method. A. M. BUNYAK and V. P. KOVAL'CHUK. *Sakhar. Prom.*, 1971, **45,** (5), 29–32. A high-frequency contactless conductimeter is described which was used in tests on controlling press water and intermediate product dry solids. The sample is placed in a glass tube surrounded by a single-layer winding. The conductance of the sample governs the generated frequency, which is amplified by a semi-cascade, wide-band amplifier with positive feedback through the resistance-inductance circuit of the primary cell, i.e. the glass tube. The pass band has a frequency range of 4–10·5 MHz. Comparison of a curve of resistance *vs.* Brix obtained with a "Salometer" (produced by The Sugar Manufacturers' Supply Co. Ltd.) with a curve of frequency *vs.* Brix based on conductimeter readings using an electrode conductimeter and the instrument described above shows great similarity, both instruments being subject to error caused by temperature variation.

[1] *I.S.J.*, 1970, **72,** 153.

Application of temperature compensation would reduce the error to 0·2–0·5%, i.e. that due to measurement of oscillation frequency.

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The factory balance. S.A.S.T.A. CHEMICAL CONTROL COMMITTEE. *Proc. 44th Congr. S. African Sugar Tech. Assoc.*, 1970, 33–35.—The financial importance of sugar losses (real and apparent) are briefly discussed and attention given to matters considered by the Committee which affect the accuracy of the factory Brix balance, including the effect of suspended matter in mixed juice on its analysis, the use of refractometers for Brix determination, and the standardization of factory methods and reporting.

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A factory chloride balance. A. W. MACGILLIVRAY and B. M. STUART. *Proc. 44th Congr. S. African Sugar Tech. Assoc.*, 1970, 36–39.—Chlorides are not destroyed in cane sugar processing and the chloride balance has been proposed as a basis for factory balance calculations. With the advent of rapid and accurate potentiometric determination, this has become a practical possibility, and a balance has been established in a raw sugar factory. The analytical method, sampling, and establishment of the balance are described; with further improvements such a balance could become a useful tool in factory control.

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A solids balance investigation. E. L. MULLER. *Proc. 44th Congr. S. African Sugar Tech. Assoc.*, 1970, 40–45. The use of Brix loss is recommended as providing a better understanding of factory performance than the Non-Sucrose Ratio currently in use in South Africa, and an attempt described at the calculation of a solids balance. The solids balance achieved, however, appears no more accurate than the simple Brix balance, although it also includes all suspended, i.e. insoluble, solids. However, further work is in progress to refine the establishment of the solids balance.

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Syrup weighing at Empangeni. R. D. ARCHIBALD and M. A. KARLSON. *Proc. 44th Congr. S. African Sugar Tech. Assoc.*, 1970, 46–47.—In an attempt to trace unknown losses, syrup was weighed using a Servo-Balans scale. Over a 12-week period, the sucrose in mixed juice was 36,970 tons but undetected loss was 1017 tons; of this, however, only 181 tons was lost during evaporation, so that the loss after the syrup scale was much greater. Part of the loss was not real and 160 tons was due to inflation of the Brix of mixed juice by suspended matter.

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Dry solids, spindle and refractive Brix data. G. D. MCGRATH. *Proc. 44th Congr. S. African Sugar Tech. Assoc.*, 1970, 48–50.—Spindle Brix and dry solids in molasses were determined by methods laid down in the *Laboratory Manual for South African Sugar Factories* while refractometric Brix was determined at 20°C after dilution with an equal weight of water and filtration. The difference between spindle and refractometric Brix varied from 2·5 to over 7 units; refractometric Brix remained close to 3 units higher than dry solids, while spindle Brix varied between 5 and 11 units higher.

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The mutual clarification project—Progress report No. 2. L. M. S. A. JULLIENNE, M. MATIC and M. TEOKAROVIC. *Proc. 44th Congr. S. African Sugar Tech. Assoc.*, 1970, 71–80.—Data collected in connexion with the Mutual Clarification Project[1] during the 1969/70 season are presented and discussed in relation to juice and sugar quality, filter performance, etc. It was shown that retention for 2–3 minutes at an average of 40°C and pH 5·5 permits hydrolysis, to the extent of over 40%, of soluble starch in juice by the natural enzymes present; such conditions can exist in the retention tank under the juice scale which receives the Oliver filtrate also. Conditions vary from factory to factory, however, explaining the differences in the extent of starch removal in factories not applying a specific removal process. Alternate use of hot (102°C) liming and normal liming (70°C) at fortnightly intervals at one factory showed that juice colour and turbidity were improved by the hot liming but mud solids were higher, mud volume lower and filter retention better with normal liming. Affined sugar filtrability and colour were not significantly different.

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Composition of South African final molasses. A. W. MACGILLIVRAY and M. MATIC. *Proc. 44th Congr. S. African Sugar Tech. Assoc.*, 1970, 81–87.—A survey has been carried out on the composition of final molasses from South African sugar factories. Regional and seasonal trends have been noted in various parameters (colour, reducing sugars, ash, gums, etc.) and comments made on the degree of exhaustion of the molasses. Included in the survey are data on the non-sucrose constituents of molasses and the inorganic ash components. Comparisons are made with a similar survey conducted in 1955/56.

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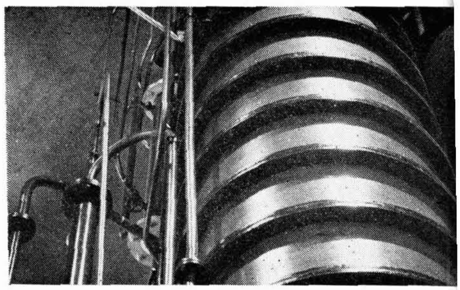
Isolation and partial characterization of oligosaccharides in refinery molasses. P. G. MOREL DU BOIL, K. J. SCHÄFFLER, G. W. COMRIE and D. M. OOSTHUIZEN. *Proc. 44th Congr. S. African Sugar Tech. Assoc.*, 1970, 98–103.—In addition to raffinose (0·5% by weight), another trisaccharide was isolated from refinery molasses by carbon/"Celite" column chromatography (also 0·5%). On hydrolysis, it yielded levulose and dextrose in a 2:1 ratio, indicating that it was a fructosyl sucrose.

[1] *I.S.J.*, 1971, **73**, 20.

By-products



Beet pulp and its history. X. DUCHENE. *Hautes Etudes Betterav. Agric.*, 1971, (8), 17–21.—The article deals not only with beet pulp as exhausted cossettes but also with the earlier beet sugar factory processes in which the juice was extracted not from cossettes but from pulp, which was either treated by hydraulic press or in centrifugals. The development of pulp drying for use as animal fodder is described and reference made to the incorporation of molasses.

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Dependence of side pressure on density in dried beet pulp briquetting. M. G. PARFENOPULO and N. E. KARAULOV. *Sakhar. Prom.*, 1971, **45**, (2), 26–28. Empirical formulae have been derived from experiments on briquetting of beet pulp and pulp-molasses mixture. These relate the pressure exerted on the side of the punch die to briquette density and moisture content and to molasses content (where appropriate).

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Relative feeding value of wet distillers' molasses. Y. KUDO, A. KATADA and M. HAYAKAWA. *Res. Bull. Hokkaido Nat. Agric. Expt. Sta.*, 1969, (94), 53-60. Milk yields and compositions were the same when dairy cows were fed on daily rations containing 6 kg of dried beet pulp or 40 kg of distillers' molasses plus concentrates, in quantities corresponding to milk yield, and 7 kg of hay.

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Criteria for evaluating *Aspergillus niger* **conidia for citric acid biosynthesis.** I. JANUSZEWICZ, H. JASZCZURA and S. KAMIŃSKI. *Gaz. Cukr.*, 1971, **79**, 43–45.—Tests are reported in which various strains of *A. niger* were cultured on molasses and their value for citric acid fermentation gauged from the percentage of conidia developing under the controlled conditions. Subsequent laboratory tests for biochemical activity showed that citric acid production ranged from 42% to 60% on sugar in the substrate.

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Preparation of surface-active sucrose ethers. E. REINEFELD, A. FREHSE and K. D. HEINCKE. *Zucker*, 1971, **24**, 95–103.—After partial substitution of the hydroxyl groups in sucrose by reaction with longer-chained alkyl halides and with epoxides, acrylonitrile and chloromethylalkyl ethers, the more important reaction products were separated by thin-layer chromatography and identified. From the reactivity order of the hydroxyl groups it is concluded that their acidity in alkaline solution governs the course of the substitution process; on the other hand, in the reaction with the chloromethylalkyl ethers, which took place in non-alkaline conditions, the primary alcoholic group in the glucose component was the most reactive, and the reaction was probably analogous to esterification in which the steric factors are decisive. As regards yield, none of the etherification methods was more outstanding in the production of monoderivatives. The lowest yield was obtained from the reaction with chloromethylalkyl ethers, which also seemed to have the lowest selectivity. Measured value of the surface tensions for 0·001 mol aqueous solutions are tabulated for the various ethers.

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Rumen parakeratosis in beef cattle fed *ad libitum* **molasses/urea, protein and restricted forage.** T. VERDURA and N. PERÓN. *Rev. Cubana Cienc. Agríc.*, 1970, **4**, 213–216.—Pathological changes in the rumen walls of bulls given molasses/urea *ad libitum* plus a protein supplement and restricted forage are described. It is suggested that the condition may be a result of inadequate forage consumption.

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Pulping methods of bagasse for newsprint making. Y. FAHMY, M. H. FADL and N. A. FADL. *J. Chem. UAR*, 1969, **19**, 219–227; through *J. Appl. Chem. Biotech.*, 1971, **21**, Abs. 1120.—Bagasse was subjected to different pulping methods and the optical and mechanical properties of the pulps were studied. Paper sheets were prepared by blending different types of bagasse pulps as well as wood pulps. Among the chemical pulping methods investigated, the alkali sulphite method was superior to soda and sulphate methods. The semi-chemical methods produced pulps of high opacity but low strength. Strength was improved by reducing the chemical treatment and intensifying the subsequent mechanical treatment. Mechanical bagasse pulp gave better paper sheets when blended with chemical bagasse pulps rather than with wood pulps. It is considered possible to produce sheets acceptable for newsprint from 100% bagasse pulps, using unbleached semichemical sulphite pulps alone or blended with approx. 50% bleached chemical bagasse pulp.

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Rum manufacture. J. R. NUGENT. *Proc. 1st Conf. Sugar Tech. Assoc. Trinidad and Tobago*, 1967, 129–131. The processes used at the Caroni distillery in the production of rum and alcohol from cane molasses are described.

Alkaline extraction of nitrated cane bagasse. N. L. LUNA. *CubaAzúcar*, 1969, (Oct./Dec.), 13–16, 49–50. Treatment of bagasse with nitric acid reduced the lignin content from 19·38% to 18·85% while the pentosans were reduced from 26·25% to 17·76%. Extraction with caustic soda then gave a pulp containing 89·8% cellulose, 1·94% lignin and 8·87% pentosans; a study of the optimum conditions of extraction showed that the temperature should be between 90°C and boiling point, duration should be at least 40 minutes, and the bagasse:NaOH ratio should be between 1:15 and 1:20. It was found that at between 1% and 3% NaOH concentration there was an increase in loss of weight (through cellulose destruction) directly proportional to the increase in NaOH concentration; the importance of this aspect needs further study as does the quality of the pulp produced.

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The fermentation of sugar in freshly milled bagasse fibre. E. F. NICHOLS. *Proc. 2nd Conf. Sugar Tech. Assoc. Trinidad and Tobago*, 1968, 71–74.—Experiments to determine the rate of sugar loss in bagasse fibre intended for use in the production of building materials showed that storage for about 24 hr at 40% moisture content reduced the total sugars (% fibre) from 6–7% to a maximum of 1% (the desired level), whereas low-temperature drying for up to 27 hr retarded sugar loss and necessitated a storage period of at least 120 hr to eliminate most of the sugar. Treatment of 40-lb bagasse samples with 10 ml of 5% sodium pentachlorophenate solution had little effect on the rate of sugar loss. Volumetric determination of sugars was more reliable than pol determination.

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Utilizing the sugar beet top crop. L. HARRIS and D. CLANTON. *Sugar J.*, 1970, **33**, (6), 22–23.—The value of sugar beet tops, made into silage, for different classes of livestock is discussed. The tops are also compared with corn or maize as a silage material. Advice is to give lambs all the beet top silage they will eat for best results in fattening rations, and to feed cattle with limited amounts of beet top silage (8–12 lb per head daily) or feed it with equal parts of beet silage and corn silage. Beet top silage produces a much greater laxative effect in cattle than in lambs.

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Molasses and cane tops for cattle feeding. ANON. *S. African Sugar J.*, 1971, **55**, 102.—A new concept of fattening cattle by means of liquid molasses and cane tops has been proved to be commercially practicable and is described. Feeding experiments with oxen for 86 days using a ration of mixed molasses and cane tops supplemented with a high protein concentrate showed the cost of the ration to be 0·7 cents/lb compared with 1·5 cents/lb for maize-based beef. No ill effects were suffered. Weight gains were from 0·79 to 0·91 kg (1·75–2 lb) per head per day. Molasses and cane tops are cheap in the cane belt.

US firm builds bagasse pulp and paper mill in Thailand. ANON. *Sugar y Azúcar*, 1971, **66**, (2), 18–19.—A brief non-technical description is given of the Siam Kraft Paper Co. mill at Ban Pong, Thailand, constructed with the assistance of Parsons & Whittemore Inc. It produces 190 tons of kraft paper and 66 tons of pulp per day using mainly bagasse as raw material.

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Expansion programme under way for Philippines sugar cane complex. ANON. *Sugar y Azúcar*, 1971, **66**, (3), 17–20.—A summary is given of equipment to be installed at Central Azucarera de Bais for expansion of capacity from 4800 to 5200 metric tons of cane per day. More details are given of the bagasse pulp and paper operations at the associated plant which manufactures 35 tons of pulp per day, 38 tons of paper and 20 tons of bagasse chipboard. A long-term expansion programme is intended to raise paper production to 150 tons/day, which will utilize all the bagasse produced by the sugar factory.

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Sugar beet saponins. O. S. GAŠIĆ and M. A. PERGAL. *Glas. Khem. Drushtva*, 1970, **45**, 313–320.—Of methods used to isolate raw saponin from carbonatation mud and beet, that of ROTHER[1] gave maximum yields, viz. 1% from carbonatation mud, 0·32% from the beet root, 0·40% from the rind and 0·038% from the pith. Thin-layer chromatography using 4:7 *n*-hexane:ethyl acetate as developer was applied to qualitative determination of the saponins and separation of their components. The R_f values are given for the six components found. Tests with *Kalandra granaria* showed that saponin is not effective as an insecticide, although in tests with *Alternaria tenuis* (a spotting disease of beet) it did exhibit significant fungicidal effects. Saponin also has effect on haemolysis of the erythrocytes.

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The production of newsprint from sugar cane bagasse. L. E. M. GARAYBLAS, R. SAMANIEGO, L. A. YNALVEZ and P. BAWAGAN. *Sugar News* (Philippines), 1970, **46**, 467–475, 479.—Experiments are described intended to devise the most suitable blend of bagasse pulps obtained by different processes, in order to produce acceptable newsprint; it was found that newsprint comparable to the commercial product of North America could be made using a furnish of 60% unbleached NSSC (neutral sulphite semi-chemical) pulp, 20% unbleached mechanical pulp and 20% bleached sulphate pulp. Characteristics of the different kinds of pulp are different and affect the product; too much mechanical pulp gives insufficient strength, while too much NSSC pulp makes the newsprint stronger and stiffer than it need be. Further studies are needed to reduce the yellow colour of the newsprint.

[1] *Zucker*, 1962, **15**, 186–191.

Patents

UNITED KINGDOM

Production of edible protein-containing substances. RANK HOVIS McDOUGALL LTD., of London E.C.3, England. **1,210,356.** 29th November 1966; 28th October 1970.—The process comprises incubating and proliferating, under aerobic conditions, (at 25–35°C and pH 4–7) a non-toxic strain of the microfungus *Fungi imperfecti* in a culture medium containing essential growth-promoting nutrient substances including carbon in the form of an assimilable carbohydrate substrate (molasses, bagasse waste) (and an antifoaming agent). When the carbohydrate is exhausted the proliferating organism is separated (and filtered under pressure to reduce its water content to below 50% w/w). The mould produced is edible and contains protein, lipids, carbohydrates and vitamins of the B group.

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Control of crystallization apparatus. SOC. FIVES LILLE-CAIL, of Paris, France. **1,227,701.** 4th March 1969; 7th April 1971.—Control of the operation of a continuous vacuum pan, comprising a series of compartments through which a massecuite passes, is achieved by measuring the percentage of crystals or density of the massecuite leaving the last compartment, and rapidly adjusting its composition by automatically adjusting the supply of under-saturated feed liquor and/or heat to the last compartment in accordance with the signal produced by the measuring element, and also less rapidly adjusting the composition of the massecuites in previous compartments in the same manner. The regulator(s) which adjusts the heat and liquor supply to the intermediate compartments receives the signal from the measuring element through a low-pass filter (RC system).

Beet thinner. H. FÄHSE & CO., of Düren, Rhineland, Germany. **1,230,001.** 9th July 1968; 28th April 1971.

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Beet harvester. S. A. HERRIAU, of Cambrai (Nord), France. **1,235,485.** 5th April 1968; 16th June 1971.

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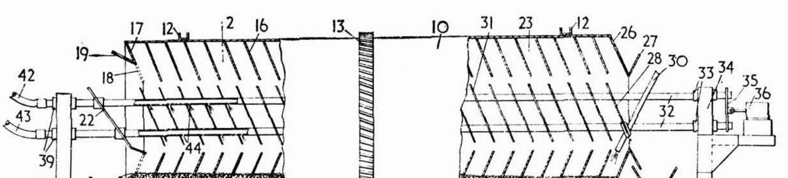
Preserving dilute sugar solutions. F. & M. SCHAEFFER BREWING CO., of Brooklyn, N.Y., USA, and WASHINE CHEMICAL CORPORATION, of Lodi, N.J., USA. **1,236,036.** 28th November 1968; 16th June 1971. Sweet waters—solutions containing 1–50% (1–20%) of fermentable sugar (sucrose)—are protected against microbial loss by mixing with it 5–50 ppm (10–15 ppm) of *n*-heptyl *p*-hydroxybenzoate either in acid, alkali metal salt or alkaline earth salt form.

* * *

Beet or cane diffuser. O. D'HOTMAN DE VILLIERS, of Durban, Natal, South Africa. **1,237,863.** 21st August 1967; 30th June 1971.

The cylindrical drum 10 is supported on guide rollers 11 running in channels 12 on the outside of the drum. The rollers are mounted on piers 40, 41, pier 41 being higher to give the required inclination to the horizontal. A toothed ring 13 meshes with gear 14 driven by motor 15 for rotation of the drum. The interior is divided into compartments 23 by dished annular discoid partitions 16 which are perforated, while the upper end is closed by the annular un-perforated plate 26, which is fitted with a deflector 27. The lower end of the drum is closed by the plate 17 which is perforated only over its inner part 18 beyond the point where deflector 19 is fitted.



Within the central aperture of the partitions 16 are a series of baffle plates 28 mounted on tubes 32; these are mounted in guides 33, 39 carried by piers 37, 38. The tubes 32 are linked by plate 35 and a reciprocating movement imparted by motor 36. Liquids,

Copies of Specifications of United Kingdom Patents can be obtained on application to The Patent Office, Sale Branch, Block C, Station Square House, St. Mary Cray, Orpington, Kent, England (price 25p each). United States patent specifications are obtainable from: The Commissioner of Patents, Washington, D.C. 20231 USA (price 50 cents each).

steam or air may be admitted through pipes 42, 43 to the tubes 32 and so into the drum through perforations 44. Each of the compartments 23 is divided into seven pockets by a series of seven flights which are perforated and mounted at an angle to the radius of the drum. Solid particles, particularly pieces of shredded cane, are fed through chute 22 into the first compartment 23 and enter each pocket in turn as the drum rotates. They are lifted within the pockets, eventually falling onto the baffle 28 which directs them into the adjacent compartment and so on up the drum, finally being discharged by the end baffle 28 into the trough 29.

Water, admitted to the higher end of the drum through pipe 30, flows along it under gravity, through the perforations of the plates 16 and so becomes richer in sucrose, eventually being discharged as a juice over the lip of deflector 19 into trough 20.

* * *

Manufacture of aragonite. TATE & LYLE LTD., of London E.C.3, England. **1,239,407.** 25th September 1967; 14th July 1971.—Aragonite is a form of calcium carbonate of use in pharmaceuticals, in dentifrice and cosmetics, as a filler and pigment extender and as a filter-aid. It may be produced by reacting CO_2 with (1/20—$\frac{1}{2}$ molar) $Ca(OH)_2$ dissolved in a (20–50°Bx) solution of sucrose (at pH 7–9 and) at 60–90°C in the absence of crystal poisons in amounts preventing aragonite formation (and during a residence time of precipitated material in the reaction mixture of 15–60 minutes). The sucrose solution remaining is passed through an anion exchange resin and recycled for further use.

* * *

Beet topper. MOSKOVSKY INSTITUT INZHENEROV SELSKOKHOZYAISTVENNOGO PROIZVODSTVA IMENI V. P. GORYACHKINA, of Moscow, USSR. **1,240,596.** 11th April 1969; 28th July 1971.

* * *

Beet harvester. DNEPROPETROVSKY ZAVOD SELSKOKHOZYAISTVENNOGO MASHINOSTROENIA, of Dnepropetrovsk, USSR. **1,240,906.** 22nd April 1969; 28th July 1971.

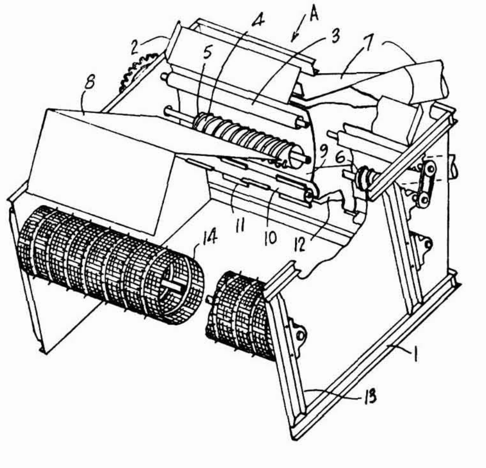
* * *

Treatment of bagasse. C. L. WRIGHT, of New Maldon, Surrey, England. **1,242,257.** 16th October 1968; 11th August 1971.—Bagasse (in the form of fibrous chips) of less than 50% (20–40%) moisture is stabilized against mycelial deterioration by substantially uniform treatment with a fungicidal acid [an alkane monocarboxylic acid which is liquid at room temperature or miscible with water over a wide range of proportions (formic, acetic or propionic acid)] in the liquid phase in such an amount as to reduce the average pH to 4·5 or below (3·7–4·2). The stabilized material may be reduced to the desired particle size, dried to 2–5% moisture content, glued, spread and pressed under conditions whereby the glue is cured, so giving a chip board.

* * *

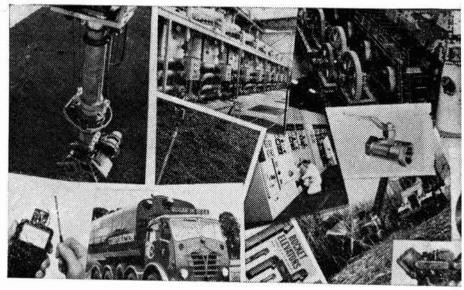
Dry cane cleaning and spreading. THE COLONIAL SUGAR REFINING CO. LTD., of Sydney, N.S.W., Australia. **1,243,463.** 15th January 1969; 18th August 1971.

A frame 1 is mounted on a buggy or cane cart which receives the billets discharged in direction A by a chopper-type cane harvester. The cane falls onto chute 2, forming a curtain, typically 3 ft long by 1 ft wide. An air duct 7 extends horizontally across the frame and delivers an air jet across and through the curtain of cane falling from the chute to separate light extraneous matter such as trash. "Spreading" rollers 3, 4 are located below the chute with about 3 inches clearance between them; roller 3 is of about $4\frac{1}{2}$ inches diameter and roller 4 of about 9 inches diameter with flange-like helices 5, 6, of opposite hand so that clockwise movement of both rollers (viewed from the nearer side in the illustration) will assist separation of the curtain towards each side of the frame.



Pieces of cane which have passed through the spreading rollers, now in a 6-ft long curtain, fall onto a deflector sheet 9 and towards a rotating throwing roller 10 which carries longitudinal vanes 11. These direct the cane horizontally across the frame, the horizontal movement being aided by a jet of high-velocity air delivered from air duct 12. This air captures most of the residual light-weight trash and carries it upward over the roller 14 and through the gap where it mixes with the trash carried over cowl 8. The roller 14 has a surface of coarse wire mesh and carries spikes which aid the separation of the relatively higher density extraneous matter such as cane tops. The cleaned cane falls towards the collecting bin of the cleaner.

Trade notices



Statements published under this heading are based on information supplied by the firm or individual concerned. Literature can generally be obtained on request from the address given.

"Femco" filter aids. Filter-Media Co., P.O. Box 19156, Houston, Texas, 77024 USA.

"Femco" filter aids are made from volcanic ash deposits in Arizona, USA; the dark grey ore, containing 2–6% combined water, is crushed and heated to 1600°F, causing it to expand to about 20 times its original volume and forming white glassy particles. This inert material is then ground, treated, purified and classified. During filtration, the jagged particles, which are slightly curved, interlock to form a tough filter cake of 80–90% void space, which produces a considerable number of microscopic channels, interconnected to provide excellent permeability for passage of the juice, yet fine enough to retain even extremely small particles. Widely used in the US sugar industry, "Femco" filter aids have a number of advantages which are set out in Technical Bulletin No. 869, available from the manufacturers. This publication also gives the chemical composition and physical properties, grades and typical applications.

* * *

PUBLICATIONS RECEIVED

BROUSSARD "FLEX-BOOM" CANE LOADERS. Logan Perkins (USA) Ltd., P.O. Box 15317, New Orleans, La., 70115 USA.

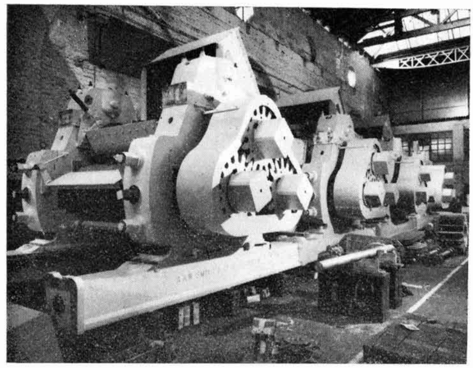
Manufactured by the Broussard Machine Co. Inc., of St. Martinville, La., USA, the "Flex-Boom" cane loader has a capacity of 250–450 tons/day depending on field conditions, etc. and has a lifting capacity of 2000 lb, while grab capacity is 1500 lb at a 58-inch opening. Loading height of model FB-26 is up to about 13 ft 5 in, while maximum for the FB-22 is 12 ft 11 in, both at a loading radius of 9–11 ft. Full details are available in literature obtainable from Logan Perkins at the above address.

* * *

Centrifugals for Thailand.—Thomas Broadbent & Sons Ltd. have recently received orders from Thailand for 24 batch-type centrifugals worth over £200,000. This is the largest number of batch machines to be supplied by the company to Thailand in any one year since they first did so in 1965 and will bring the total number of Broadbent centrifugals in that country to 94. Repeat orders have also been received from Belgium, Colombia, El Salvador, USA and Venezuela.

* * *

Cane mill for Zambia.—The 12-roller cane mill tandem shown in the photograph was built by A. & W. Smith & Co. Ltd. as a major part of their £1,250,000 contract for the supply of plant and ancillary equipment to the Zambia Sugar Co. Ltd.



to increase the capacity of Nakambala sugar factory from 2500 to 4500 short tons of cane/day. Weighing 350 tons, the tandem will be added to existing cane milling plant to make a complete tandem of eighteen 35 × 66-in rollers. Hydraulic rams operating at a pressure of 1100 psi will exert a force of 580 tons on each top roller of the new unit.

* * *

Haft Tappeh expansion.—The illustration shows work in progress at Haft Tappeh cane sugar factory (Iran), which is being expanded from 6,000 to 12,000 t.c.d. by Stork-Werkspoor Sugar N.V., of Hengelo (O), Holland.

ISJ Panel of Referees

FRANK M. CHAPMAN, one of the original members of our Panel of Referees, retired from the post of Technical Advisor—London Refineries, of Tate & Lyle Ltd. some time ago, and has since been in business as a Consultant Sugar Technologist with his office in Vancouver, Canada. In spite of this activity he has found time to serve as a Referee for us, and we are most grateful for his kindness in so doing. The time has come, however, he has decided, when he is no longer able to continue to be a member of our Panel. We must therefore wish for the continued success of his consultancy, while expressing our gratitude for his past efforts.

Mr. GEORGES PIDOUX has kindly agreed to join the panel and to serve as a Referee. Mr. PIDOUX was born in 1915 and studied at the Ecole des Hautes Etudes Industrielles at Lille in Northern France. After service as an infantry officer during World War II, he joined the staff of the Orange sugar factory of Société des Raffineries de Sucres de Saint-Louis, Marseilles, gaining experience during the subsequent eight years of beet sugar manufacture and also of cane sugar manufacture in Madagascar. In 1951 he was appointed head of the laboratories of the Marseilles cane sugar refinery where he developed the facilities for chemical and bacteriological control and the application of statistical methods.

With the formation of the Générale Sucrière company in 1968 he has been attached to the Factories Management R & D Department, concerned with applied research. His interests are indicated by the many papers he has published on crystal content in refinery and beet molasses, conductimetry, conductivity control in pan boiling of high-purity liquors, properties and structure of sucrose solutions, viscosity, sucrose solubility, nucleation, granulometry of sugars, etc., while he has contributed to several patents granted to the company.

He has received awards for his work from the Syndicat National des Fabricants de Sucre de France, the Verein Deutscher Zuckertechniker and the Société des Ingenieurs Civils de France. Mr. PIDOUX is an Associate Referee for Subject 25 of ICUMSA (Crystallizing qualities of sugar solutions), and in 1970 was elected a member of the Scientific Committee of the C.I.T.S.

Brevities

French food industry exhibitions.—The 20th International Packaging Exhibition will be held in Paris from the 13th to the 18th November 1972 at the Parc des Expositions, Porte de Versailles, as part of INTERAL 72, the biennial Food Fair. The Packaging exhibition will include sections concerned with machinery for wrapping, sealing and filling of solid and liquid food products into bags, sachets and cartons, materials for packaging, and the printing and manufacture of packages. In addition there will be numerous other parts of INTERAL 72 including MATERAL—the International Food Industries Equipment Exhibition, and SIAL—the International Food Products Exhibition. The Fair and Exhibitions will be open from 9 a.m. to 6 p.m. daily, and further information may be obtained from Information & Développement, 42 rue St.-Lambert, 75 Paris 15e, France.

* * *

The late Dipl. Ing. W. von Proskowetz.—We regret to report the death, after a short severe illness, of Dipl.Ing. WILFRIED VON PROSKOWETZ, Direktor of the Oesterreichischen Zuckerindustrie A.G., shortly after his 85th birthday. He was a distinguished technologist and member of the Verein Deutscher Zuckertechniker, as well as being widely-travelled in beet sugar countries. He will be sadly missed by his friends who will no doubt also hope to retain the physical activity and sharpness of intellect which were characteristic of von PROSKOWETZ in spite of advancing age.

* * *

Philippines sugar production, 1970/71[1].—The final figure for sugar production from the 1970/71 crop amounts to 2,268,731 short tons, tel quel, compared with 2,123,689 tons in the previous crop.

* * *

Colombia bagasse paper plant[2].—Ingenio Riopaila has announced the establishment of a bagasse utilization plant for the manufacture of paper.

* * *

New sugar factory in Bolivia[3].—A new sugar factory with an annual production of some 70,000 tons of sugar is to be erected in the district of the Altobeni river in the Department of La Paz.

* * *

Ireland sugar imports and exports[4].—Of the 39,440 long tons of sugar imported into Ireland in 1971, all but 3 tons came from the West Indies and Guyana. Sugar exports, as refined sugar, totalled 13,489 tons, of which 8830 went to the UK and 4659 to the USA.

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[1] C. Czarnikow Ltd., *Sugar Review*, 1972, (1065), 42.
[2] *Zeitsch. Zuckerind.*, 1972, **97**, 116.
[3] F. O. Licht, *International Sugar Rpt.*, 1972, **104**, (6), 6.
[4] C. Czarnikow Ltd., *Sugar Review*, 1972, (1064), 38.

Brevities

Bagasse board manufacture in Mauritius[1].—The Mauritius firm, Universal Board, is producing 10 tons per day of bagasse board. In addition to extensive use by local furniture manufacturers the board has also been exported to Mexico and Belgium.

* * *

Colombian sugar exports, 1971[2].—Sugar exports from Colombia in 1971 reached 161,000 tons, valued at US $18,000,000, compared with 128,900 tons ($14,300,000) in 1970. The principal destinations in 1971 were Japan (70,437 tons), USA (43,224 tons), New Zealand (12,600 tons), Hong Kong (12,600 tons) and Malaysia (11,800 tons). It is estimated that exports in 1972 will amount to 200,000 tons, including a US quota of 60,000 tons.

* * *

Malawi sugar expansion[3].—The Sugar Corporation of Malawi Ltd. has announced an expansion programme, to cost 2·5 million kwacha (£1,250,000), to enable the Corporation to meet its new sugar quota of 15,000 tons/annum for the USA. New machinery is to be installed in the factory and the cane area is to be increased from 6600 acres to approximately 12,000 acres by March 1973. Sugar production will be raised from 42,000 to 63,000 tons/year by 1973.

* * *

Sugar cane smut in Hawaii[4].—Cane smut has been found for the first time in Hawaii in the island of Oahu near Honolulu International Airport, where it is thought to have been introduced on a plant brought into the islands by a traveller. HSPA scientists are working with the state's agriculturalists to minimize spread of the disease. No especial problem is anticipated, and smut-resistant varieties will be used and seed cane treated before planting.

* * *

Bangladesh sugar imports[5].—Owing to the war, sugar production in the former East Pakistan was reduced and, as a consequence, Bangladesh is to import 85,000 tons of sugar to avoid scarcity.

* * *

Iceland sugar imports, 1971[6].—Sugar imports into Iceland in 1971 totalled 9664 metric tons, tel quel, compared with 10,294 tons in 1970. The largest supplier was the UK with 3814 tons, followed by Czechoslovakia with 1218 tons, Finland with 976 tons and East Germany with 924 tons.

* * *

US beet area, 1972[7].—The area to be sown to beet for the 1972 crop will amount to 1,388,000 acres (561,704 hectares) or 1·1% less than in 1971. Although all controls have been lifted from sugar beet cultivation and no recommendation has been made for a reduction of the area, it has been reduced for the fourth consecutive year. At an average beet yield, a crop of 25 million short tons of beet might be expected in 1972, compared with 26,874,000 tons in 1971, when the yield averaged 20·1 short tons per acre (45·05 metric tons/ha).

* * *

Finland sugar imports and exports, 1971[8].—Imports of sugar into Finland in 1971 totalled 209,856 metric tons, tel quel, over half coming from the USSR (136,848 tons), 33,468 tons from Australia, 24,203 tons from Brazil and 11,952 tons from the Dominican Republic. Exports of sugar totalled 51,482 tons in 1971, of which 33,554 tons went to Sweden, 12,438 tons to Norway and smaller quantities to other countries.

* * *

Czechoslovakian sugar factory for Egypt[9].—A trade agreement has been signed between Czechoslovakia and Egypt; the terms include participation by Czechoslovakia in the erection of a sugar factory in Egypt.

Commission Internationale Technique de Sucrerie

A meeting of the Scientific Committee of the C.I.T.S. was held in Neu-Offstein and Mannheim during the 18th and 19th April under the Chairmanship of Professor F. Schneider, the Committee being the guests of the Süddeutsche Zucker-A.G. On the first day of the meeting the members were welcomed to the company's central laboratory at Neu-Offstein by Mr. H. Schiweck and were able to inspect closely the scientific and technical equipment in use. Communications were presented by Mesdames Büsching and Zaorska and by MM. Cornet, Gross, Kronewitz, Landi, Lescure, Pieck. Reinefeld, Schliephake and Tjebbes.

Professor Schneider made a number of proposals for extending the activity of the Committee and announced that its next meeting would be held on the 12th June 1973 at the Lodz Institute of Technology in Poland, at the invitation of Professor Zagrodzki. The Committee decided on the subjects for priority at the 15th General Assembly of the C.I.T.S. which is to be held at Vienna in 1975; these subjects will be (1) The basic principles of extraction from beets, and (2) The behaviour of non-sucrose substances during the sugar manufacturing process.

Japan sugar imports[10]

	1971	1970	1969	1968
	(metric tons, tel quel)			
Australia	472,169	510,192	577,925	501,422
Brazil	25,773	143,578	37,714	—
Colombia	51,050	45,994	59,419	50,479
Cuba	1,050,825	1,093,431	829,132	564,995
Dominican Rep.	163,933	63,155	—	—
Fiji	15,165	5,325	24,118	11,468
Mexico	—	—	—	28,326
Réunion	—	—	—	10,456
Ryukyu	226,249	217,771	223,996	231,652
Salvador	6,330	6,337	10,038	—
South Africa	275,005	373,050	346,544	486,987
Taiwan	164,148	108,723	118,780	167,340
Thailand	46,723	32,378	—	—
Other Countries	—	26	—	198
	2,497,370	2,599,960	2,227,666	2,053,323

Brazilian sugar machinery export[11].—The Brazilian sugar machinery companies MAUSA (Metalurgica de Accesorios para Usinas S.A.) and M. Dedini S.A., both of Piracicaba, São Paulo, Brazil, have provided equipment for sugar factories in Brazil for more than a half-century. Recently, they have signed a contract for export of a complete cane sugar factory, Santa Maria, for Venezuela. It is to have a capacity of 2500 tons of cane per day with the possibility of extension to 5000 tons/day, and will also include a refinery section.

1 *Barclays International Review*, 1972, (March), 16.
2 *BOLSA Review*, 1972, **6**, 162.
3 *Barclays International Review*, 1972, (March), 24.
4 *Sugar y Azúcar*, 1972, **67**, (1), 27.
5 F. O. Licht, *International Sugar Rpt.*, 1972, **104**, (7), 8.
6 C. Czarnikow Ltd., *Sugar Review*, 1972, (1066), 46.
7 F. O. Licht, *International Sugar Rpt.*, 1972, **104**, (8), 8.
8 C. Czarnikow Ltd., *Sugar Review*, 1972, (1068), 58.
9 F. O. Licht, *International Sugar Rpt.*, 1972, **104**, (8), 7.
10 C. Czarnikow Ltd. *Sugar Review*, 1972, (1065), 43
11 *Sugar y Azúcar*, 1972, **67**, (1), 42.

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Printed by JOHN ROBERTS & SONS, Salford, Manchester; 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.