KEYNOTE ADDRESS
TRENDS, CHALLENGES AND THE OUTLOOK OF WORLD CANE AND SUGAR PRODUCTION & MARKETS

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The subject is vast indeed, and I have to concentrate today on what might be most relevant for a gathering of sugar technologists coming from all over the world trying to address world - relevant questions.

- 1st question, What is the long term position of sugar in the fast increasing population of sweeteners? And what are, specially, the prospects for cane sugar?

- 2nd question, Where are the pressures to increase competitiveness? And what are the most promising areas of research and paths to follow in this perspective?

- 3rd question, How to enhance the attractiveness of sugar as a raw material for food industries?

Long term position of sugar

I will start precisely by that statement: sugar is still, but is less and less a final consumer product, the justification for its invention, development and large market. Less and less a food item, but more and more a food ingredient.

Graph One shows how sugar consumption was split (about 65 years ago in the pre-WW2 years and at 10 years intervals since 1955) between straight food and industrial food ingredient - and our prevision for the years ahead. The share of industrial usage went up sharply from pre-War times, stabilized to about 1/3 during the fifties and sixties, went up sharply in the early seventies, then had stayed at about 45% since 1980, as about 10 millions tonnes of industrial sugars were displaced by isoglucose first and intense sweeteners afterwards, and the share of developing markets, where direct consumption is far stronger, has increased. Our projection shows that the displacement is not quite complete yet and we are now in a slow process of reduction of direct intake of sugar. On a worldwide basis this intake probably reached an all time high of 12.5 kg of (raw) sugar equivalent by 1980 and in the most recent year and the years ahead of us, we are losing about 150 grams of direct per capita consumption each year (that is close to one million tonnes of sugar per year at the present world population of 5.9 billion people).

Whether or not sugar will be able to recover that much on the industrial side is the main topic of this presentation so far it is not quite the case. There is some evidence that in the last two decades, total per capita sugar consumption has not grown at all and even slightly decreased and is now just 20 kg/capita/year (raw sugar basis).

What are the prospects ahead? The fact that industrial use is the prime mover of sugar consumption is worrying because it is there that the impact of competing sweeteners has been felt. 50, even 40 years ago, the usage of competing sweeteners was very limited, perhaps 2 to 3 million tonnes of sugar equivalent. Of course, starch glucose and dextrose has long been around but had fairly different applications and markets - and the only intense sweeteners in use were saccharin and cyclamates which were considered as very poor, even dangerous, substitutes.
Between 1975 and 1985, HFCS took off and the soft drink market, already lost by sugar in the U.S. was invaded by new intense sweeteners, aspartame basically. Since then aspartame and HFCS fought their way up (and fought between each other, fortunately) and we have had at least half a dozen of potentially competitive sweeteners appearing, the most dangerous of them being acesulphame-K and, very recently, sucralose.

The future trend ahead is clear: competing sweeteners will take an increasingly large share of the overall industrial market (Graph Two).

From a 24% share in 1985 and 28% in 1995 we should be over 30% in 2005 and above 40% by 2020. The question is: if it is “just” 40% there is still some growth potential for sugar, about one million tonnes a year in the next 20 years (considering the inevitable decrease in direct sugar consumption). But if that proportion becomes 50% or 52% there is no longer any expansion prospect for sugar beyond 2010 or 2020.

Long term position for cane sugar

The other question is: assuming there is that much room for sugar in the next 20 or 25 years, what about sugar cane? From Pre-WW2 to the nineties cane used to make up for 55 to 60% of world output (Graph Three). Since then the collapse of the beet sugar industries of the former URSS has caused this percentage to rise to 72% in 1998. We do not expect beet sugar production to recover, even to increase at all in the 20 to 25 years ahead. Not that beet cannot be competitive. The yields of beet sugar per hectare and per year are, on a world basis, about exactly the same as cane’s. Some areas (in Western Europe and Chile) are very competitive indeed, but, largely for political reasons, beet producing countries have adopted sugar regimes which are at the same time quite supportive and extremely limitative for production. Basically a high price is guaranteed but only for a more or less strictly limited quantity. This is the system adopted in the E.U., the U.S.A. and now increasingly in Eastern Europe. Beet sugar can be produced at world price but beet sugar is not particularly, or no longer at least, interested in the world market. So all the growth potential is, in our projection, left for cane sugar, which might well represent close to 80% of world supply by 2020. This is quite a responsibility for cane. Cane will have to deliver the additional 30 million tonnes or so the potential market of 2020 requires. This means that it has to deliver products which are, at the same time, cheap and of high quality.

Competitiveness

Let’s turn first to cheap. This may appear quite revolting to you to imagine that such a noble product which is already quite inexpensive can continue being so, even cheaper. Well, you might say, it is not that cheap in some parts of the world and it still sells. Over $1000/tonne in Japan, $800 in the E.U., $600 in the U.S. for bulk white sugar ex factory is not cheap and the consumers and industrial users have to cope with it. The answer to that is indeed that when you ask housewives about the price of sugar in those kind of countries they just don’t know, while the industrial users do know and do complain about it, but they have alternative sources of sweeteners available and are not taken seriously anyhow by the public which knows that cheaper sugar would not yield a cheaper Coke or a cheaper chocolate bar.

All this is quite true, but still, high sugar prices promote the research for, and commercial production of, competing sweeteners (look at the U.S.A), kill the sugar-using domestic industries (look at Japan which protects its sugar industry but not, or not enough, its sugar containing products industry) and depress world consumption. It is a fact that when the world price for white sugar reaches $400/tonne some countries buy less or just stop buying.

So there is, to a greater extent than generally recognized, some price elasticity of the overall sugar demand. And the problem is that producing sugar is now more expensive than turning out substitutes. Graph Four shows what is costs to produce one tonne of raw or plantation white sugar on average in the 12 best cane areas of the world in 1995, compared with costs of isoglucose and sweeteners in the U.S. Note that there is no profit on return on capital included and that in some cane areas (e.g. Asia) the cost we have put for the raw material
Actually be higher because of its opportunity cost (that is the price of cane required to equal competing crops' gross returns). It can be seen that cane, as a raw material, when you include transportation, is 1.48 times costlier than U.S. corn (net of by-products returns of course) that year with a relatively high price of corn ($2.7 bushel, that is $106/T. The price now, early in 1999, is $85/T.

This results from the fact that when you have extracted the starch from any grain you still have the other half (the proteins bearing section) which is at least as much as valuable. From cane all you get besides sugar is water and fiber, not really exciting.

The reason why cane is so “expensive” is not exclusively, but quite basically, yields. The world average yield of sugar cane is now about 6.5 tonnes of sugar per harvested hectare. Not too bad, you would say, but bad enough when one considers that cane covers the land all year around, even more than that since plant cane is quite often harvested at 18 months and you need space for circulation within the cane fields and, very often, a fallow area. So in fact your yield per hectare per year is just above 5 tons of sugar. Of course, you have Colombia, Queensland, Florida, Zimbabwe, Maharashtra etc... to save the lot, but when you consider the bulk of cane sugar production in the world, the picture is of an extreme mediocrity. Yields must grow as otherwise cane, and therefore sugar, will not grow.

Logistics is another factor. Spending 15% of your raw material on transportation is too much. Only Queensland, and some of Southern Africa and Cuba are doing well on this aspect. South Brazil could do well with its very interesting system of trailer “trains” but the scramble for cane of the recent years has lifted up distances there as well. The picture is getting worse with recent limitations on heavy loads trucked on public roads about everywhere.

Something can be done on the factory side as well, but much less. Mills have learnt to get good recoveries, less labor with automation, and to save energy to sell electricity. The only way to progress is now size. Producing less than 50,000 tonnes of sugar per year in one factory (world average) is not enough. Doubling capacities may lead to savings on processing costs of between 15 and 20%. But this is investment. Increasing output with the same capacities (increasing the processing season length) is done everywhere, but you have the growers against you. This is complicated enough in Australia, but think of the places where the farmers want to get rid of their cane as soon as possible to sow something else, or you have competition from the small scale outfits, like in India.

The so-called “non-centrifugal” (one should say “open pan” in my opinion, as many of these units do centrifugate their massecuites) industry is not, by the way, dead at all. We believe it reached an all-time-high world output of 10 million tonnes, raw sugar equivalent, just 12 years ago and is now on the way down to 5 million tonnes by year 2020. You might say they represent a very poor way to use caneland (2 to 3 tonnes of sugar/hectare/year), which is true, but the market is still there and you still have places where crystal, even refined sugar is remelted into gur or panela because there is a premium, not a discount, for them. In fact this sector represents a largely untapped reservoir for the expansion of centrifugal sugar, which, by the way, makes us so sanguine about the prospects of the Indian sugar production as exemplified by what occurred in the neighboring country, Pakistan. One might say something similar about Brazil: “alcohol is the Brazilian gur” is not really true, but not basically false either.

I am not suggesting, by the way, that everybody should sell one’s sugar at $250/T or 11 cts/lb, far from it. I strongly believe that everybody in this place here today should make a living, and a decent one. What I am trying to say is that, since some producers are more competitive than others, world prices - and inexorably domestic prices as well- will not increase but rather, in fact, decrease in real terms, following the slope of the productivity curves in inputs per tonne sugar. This leads, on the long run, to an area reduction, not expansion, for cane. As an example an increase of 2%/year of the field yields (something which is not impossible to achieve, even though, in the last 50 years, we were rather below 1%/year) means, based on our projections, a decrease of 1%/year of the world cane area beyond 2005. We will have to learn to grow more sugar with less land-sometimes very good land - to leave space for other foods. This is an inevitable fact.
**Suggested paths to investigate**

**Table Five** indicates the paths which are, in our opinion, the most promising in the area of research, technology and investments for cane and cane sugar production.

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<tr>
<td><strong>FIELD</strong></td>
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<td>- Find a high sucrose content cane (Research)</td>
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<tr>
<td>- Develop early maturing varieties - Season Length</td>
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<td>- High density planting (Agronomy)</td>
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<td>- Decrease fertilizer application, specially nitrogen, where too high, very frequent (Agronomy)</td>
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<tr>
<td><strong>LOGISTICS</strong></td>
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<tr>
<td>- Develop continuous cutting, loading, transportation</td>
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<td>- Generalization of mechanical harvesting (green cane)</td>
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<td>- Reduction of transportation distances (feasible almost everywhere)</td>
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<td><strong>MILLS</strong></td>
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<td>- Automation (not essential everywhere)</td>
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<td>- Energy savings (quite a few, from beet experience) and cogeneration (where applicable)</td>
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<tr>
<td>- Mill size (restructuring)</td>
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<td>- Advances in quality direct white production (white ends, ultrafiltration etc...)</td>
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Note that cane genetic research policies are difficult to manage, even more to change, since they must be basically defensive as what is done to fight diseases on other crops with chemicals has to be done through resistance or tolerance for cane.

**The quality predicament**

This being said, another reason why sugar is still there and expanding, even sold at much higher prices than competing sweeteners, is that consumers and industrial users need it, cannot replace it, for most of the possible applications. It might be that it is the only sweetener available - but this is less and less true. But the basic point is less and less dietary habits and more and more food technology. It may be that, also, that the technology of use of alternative sweeteners is not under control yet everywhere. So the customers want sugar, are prepared to pay sometimes hefty prices for it, which is reassuring, but the other face of this fact is they want assurance of supply, exact and timely delivery, and good quality within exacting specifications. There are countries where the sugar market is in a state of chaos, where it is suddenly unavailable, or at three times the price of the last delivery, or totally sub-standard and terribly conditioned. This is not what you can call an industrial ingredient or feedstock. In such a case the industrial customer has every reason to look for the substitute, particularly an intense sweetener which is easier to transport and to handle.

I will concentrate in this last section on the quality problem. As a food ingredient, one could expect the best quality, properly refined cane (or beet sugar) to displace lower qualities. But, on the contrary while high quality sugars used to predominate, this is no longer the case. Industrial sugar markets have grown where such a quality could not be found, that is in the developing world where lower grades are produced straight from cane mills, mostly with sulphitation of cane juice, and users had to adjust to this fact, even to produce colas or chocolate.
This might be used as a point for not caring too much about sugar quality, but would be very short sighted since in fact low quality makes the raw material more expensive for the user (in further preliminary treatment of the sugar, variations in quality requiring additional precautions in processing, even sometimes actual loss of a batch of final product, e.g. flocc problems). True enough, many if not most users would not pay a dollar more for higher quality, but given the choice they will leave the worst quality aside. Quality is therefore as much as a competition factor as price, particularly as strictly standardized (but quite versatile: the starch sweeteners industry can turn out literally dozens of different products and the range of "mixes", sugar + starch products + intense, is literally endless) products have now got 30% of the total world usage.

There are many ways to assess white sugar quality: polarization purity, moisture, presence of invert and ashes, colour aspect and coloration in solution etc... You know better than me. In the world trade practice only two indicators have emerged, perhaps because they are both easier to measure and a presumably a good indication of how the stuff ranks on other points: pol and coloration in solution (ICUMSA units). At ERSUC we concentrate on colour and have chosen to draw the line of high/low quality (which can range from less than 10 to some 300+) at 60 ICUMSA units, which is the limit adopted by the London # 5 White Sugar Futures Contract (Paris being more exacting at 45 ICUMSA). Additionally, packaging must consist of new poly/just bags of 50 kgs with a minimum tare of 400 grams.

Consumption patterns

Well, 50% of the sugar consumed in the World stands below this standard (Graph Six). This is not just because the so-called "plantation white" grade predominates in the developing cane sugar producing world, but because about 1/3 of the so called "refined sugar" is not properly refined, the fault lying either in the quality of raw sugar itself, or the technology, or the equipment. For the low quality in direct beet whites the poor quality of the raw material (beet) may be faulted very often, more often perhaps than for cane. The 52% proportion of low quality you find on this graph has been stable for years. It has decreased on beet side because the former Socialist world, responsible for most of the low quality beet sugar, has reduced its production considerably, but this has been made up from the cane side where the proportion of plantation whites is progressing every year and where the substitution of beet by cane raws in the factories of Eastern Europe has not led (and could not lead either) to a better final product.

Production patterns

Let us turn then to production, therefore to technology (Graph Seven). While less than one per cent of beet sugar is still produced as raw sugar (and refined in the countries of production), 31% of cane sugar is originally raw sugar. Among raw cane sugars, about 15% (about 4.2 million tonnes) are very high pol (VHP) raws, a rather old invention of the South African sugar industry which still produces its raw sugar that way to feed its main, Durban, refinery, or, with or without prior pol downgrading with molasses, to export it. Brazil is now, however, the main producer (2.6 MT in 1997, much more last year) as it discovered VHP the other way, by just leaving some colour on the plantation white crystals it used to export, sometimes in bulk. Of course, Australia and Thailand may export VHP too.

Without being the result of a spectacular technology (it fits well the Brazilian two strike system used in large distilling mills), VHP raws have been a spectacular commercial success, as poorly equipped, inland based, refining units without local market for molasses have turned with enthusiasm to a product with which losses are or should be minimal. Most traditional refineries of industrialized countries (US, Europe, Japan) have stuck to the classic, low-pol types of raws, mostly for regulatory reasons (above 99° pol, raw sugar is often considered as white sugar and is charged higher tariffs), but this may change as raw sugar quality requirements rapidly escalate.

Next to VHP (with the same pol, sometimes) comes "plantation white" crystal. It ranges from the terrible (the "no1" Chinese quality = 250 ICUMSA) to the more than acceptable (carbonation process direct whites with 80 ICUMSA units). Some large sized grains types like the Chinese "pomegranate" even sometimes command premia. This is 55% of cane sugar production in 1997!
We have already discussed the role of production and trade in final consumption (back to Graph 6). Not much has changed since 1978, and I feel confident in predicting that there will be little change in the 1980s. The basic pattern of production and trade has remained the same, with some minor adjustments in detail. The share of raw materials (mostly metals and nonferrous minerals) in total exports has increased, while the share of manufactured goods has decreased. This is largely due to changes in world markets and technological developments. The pattern of importation and exportation has remained relatively stable, with a few exceptions. The largest changes have occurred in the areas of raw materials and manufactured goods. The relative importance of raw materials has increased, while the importance of manufactured goods has decreased. This is due to changes in world markets and technological developments. The pattern of importation and exportation has remained relatively stable, with a few exceptions. The largest changes have occurred in the areas of raw materials and manufactured goods. The relative importance of raw materials has increased, while the importance of manufactured goods has decreased. This is due to changes in world markets and technological developments.

Concrete Examples (Graph Right)

Since the data were produced last year, the production of raw materials has increased, while the production of manufactured goods has decreased. This is due to changes in world markets and technological developments. The pattern of importation and exportation has remained relatively stable, with a few exceptions. The largest changes have occurred in the areas of raw materials and manufactured goods. The relative importance of raw materials has increased, while the importance of manufactured goods has decreased. This is due to changes in world markets and technological developments. The pattern of importation and exportation has remained relatively stable, with a few exceptions. The largest changes have occurred in the areas of raw materials and manufactured goods. The relative importance of raw materials has increased, while the importance of manufactured goods has decreased. This is due to changes in world markets and technological developments.
DIRECT AND INDUSTRIAL SUGARS
WORLD PER CAPITA CONSUMPTION OF OPEN PAN

(Kg / Year Raw Value Equivalent)
WORLD FINAL CONSUMPTION

(1997 - 1997.2 MTRV)

HIGH QUALITY

48.9% Sugars

L.G. Beet Sugar

24.8% Raw Sugar

10.0% L.G. Sugar

9.9% H.O. Sugar

12.9% H.O. Cane Refined

39.6% Mw

52% Sugars

Low Quality
major equipment requirements - and, by the way, without losing the cane’s invert sugars in the process, as they are a major component of a valuable by product, molasses. While ion exchange is an interesting proposition, so is ultrafiltration. But this is not, I am afraid, my area.

As a conclusion, the way seems open for cane sugar to conquer additional markets for some 300 million tonnes of cane, that is the size of the present Brazilian or Indian production, in the 20 to 25 years ahead. Not bad, but provided it can prove to be a more competitive raw material than wheat or corn, or than chemistry itself, not just on cost indeed but in the battle field of food technology, therefore quality, as well.