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Sweet and sour

The impact of sugar production and consumption on people and the environment

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Sweet and sour

The impact of sugar production and consumption on people and the environment

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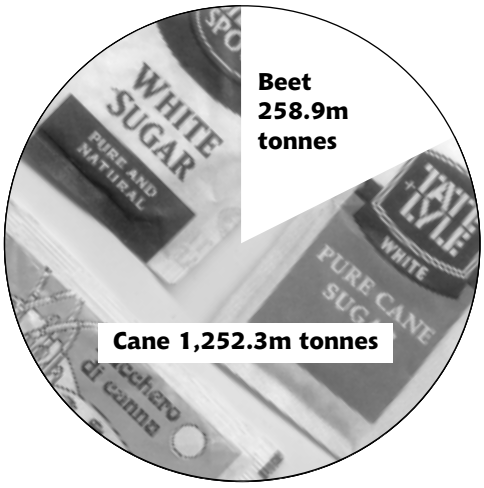
A global crop

Sugar is grown throughout the world as two main crops: sugar beet and sugar cane. Over 82% of all sugar is obtained from sugar cane, as shown in the pie chart *World production of sugar cane and sugar beet.*

Two countries, Brazil and India, dominate the production of cane producing 40% of the world sugar supply (see the table *Top producers of sugar cane*). Other important producers of cane are China, Pakistan, Mexico, Thailand, Australia and Cuba. Much of the sugar cane produced in Brazil is used as ethanol fuel, particularly when sugar prices slump.

Most sugar beet is grown in the European Union (EU) providing between 14% and 15% of the world's supply of sugar.[4] The biggest EU sugar beet producers are France (2.1%), Germany (1.8%), and the UK (0.7%). Other big producers of sugar beet include the United States (2.0%), Turkey (1.3%), Ukraine (1.1%), Poland (1%) and China (0.9%).[2]

World production of sugar cane and sugar beet[3]



What is sugar?

In nutritional terms sugar can be loosely defined as any of a number of chemical compounds in the carbohydrate group that are readily soluble in water; are colourless, odourless, and usually crystallisable; and are more or less sweet in taste. In general, all monosaccharides, disaccharides, and trisaccharides are termed sugars, as distinct from polysaccharides such as starch, cellulose, and glycogen. Commercially, the main sugars are glucose, lactose, maltose and, most importantly, sucrose. Sucrose is found principally in green plants and is manufactured during photosynthesis. The global production of sucrose is derived mainly from two plants: sugar cane and sugar beet (see *Growing sugar*). This report will focus mainly on the production of sucrose from these two plants.

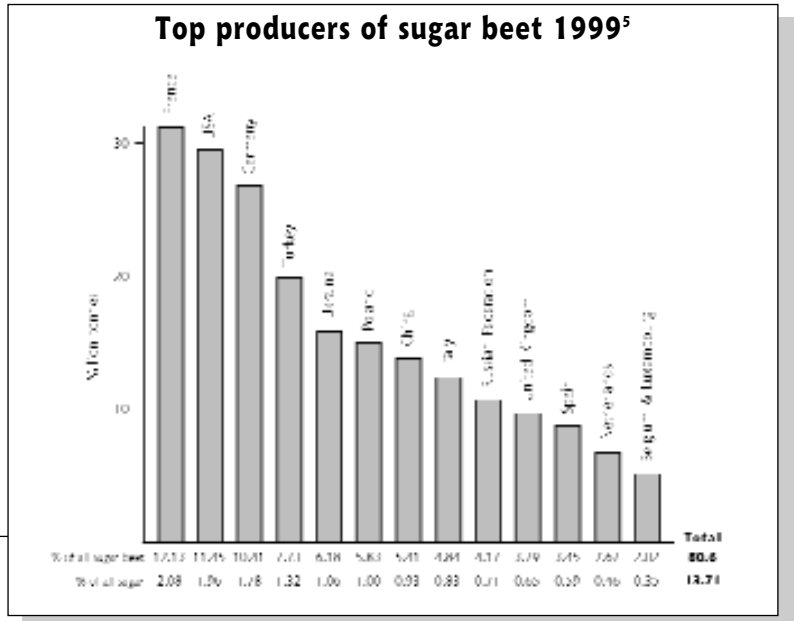
Sucrose:

- acts as a sweetener
- acts as a preservative in jams and confectionery (prevents microbacterial growth)
- is easily fermentable by yeast for brewing, breadmaking and baking
- gives the crunch in biscuits
- provides bulk in cakes and puddings
- provides calories

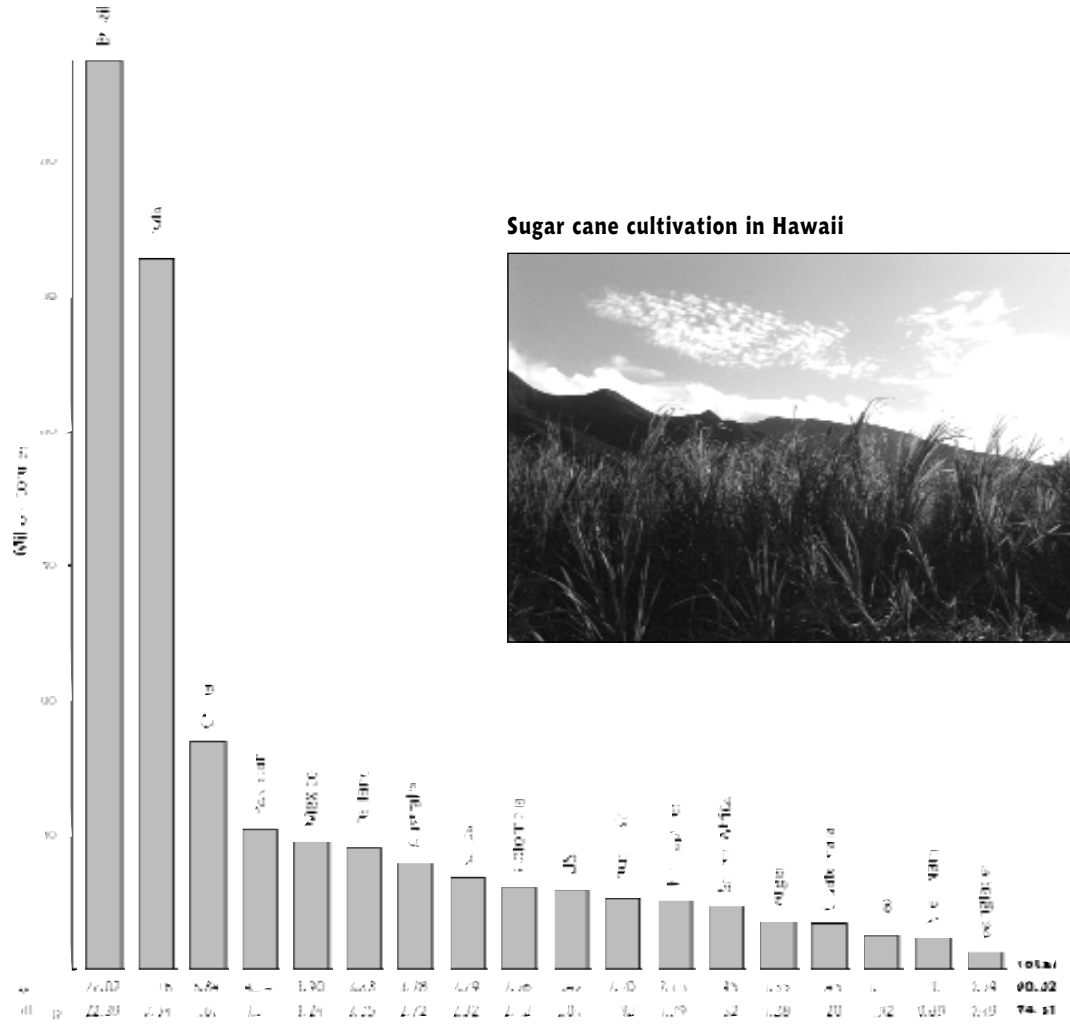
Sugar is also easy to use as it dissolves well, can be readily stored and is relatively cheap.

Silver Spoon is produced from sugar beet

Top producers of sugar beet 1999[5]



Top producers of sugar cane 1999[6]



Sugar cane cultivation in Hawaii

from cane fields. In Queensland, the combined use of stabilisation methods such as contour banks, green-manuring, retaining green-harvest residue, and no tillage have been shown to reduce soil erosion from 150 tonnes to 5 tonnes per hecatre per year.[13 14 15]

Fertiliser use

Under current farming practises, sugar cane is heavily reliant on nitrogen (N) and phosphorus (P) fertilisers to supply these nutrients. For example, approximately 63,870 tonnes of N and 7,670 tonnes of P was applied to cane fields in Queensland alone in 1994, while the industry in 1990 accounted for 71% of N and 55% of P applied to all of Queensland's coastal catchment croplands.[18]

The capacity of the environment to absorb runoff of N and P fertilisers is limited, and when large amounts are applied, it is inevitable that there will be an impact on the surrounding environment. The most common problem is excess nutrients, and trace metals often associated with fertilisers, being transported from the field in runoff from rainfall or irrigation. As with pesticides, this 'contaminated' runoff affects the quality of groundwater, rivers and streams that flow into estuaries and coastal environments.[19 20] For example, elevated nitrate levels (50 - 100mg/l) have been detected in the groundwater of sugar producing areas of Queensland. Excess nutrients in water courses often leads to the growth of algae blooms, such as blue-green algae, which are so toxic that they will poison and kill aquatic life.

Irrigation and water consumption

The production of sugar cane is highly dependent on water availability. Most sugar cane crops are supported by some form of irrigation, and large quantities of water are required during milling and processing.

The construction of major irrigation schemes is helping expand the industry into dryland areas away from its traditional base in high rainfall areas.[21 22] It has been calculated that an extra 5 million litres of water per hectare (ha) can represent an additional yield of about 3 tonnes of sugar per ha. Nearly 40% (182,720ha) of Australia's sugar cane area uses either supplementary or full irrigation, which contributes about A$214 million or 13% of the total gross value of sugar production.[23]

Irrigation schemes can harm the environment in a number of ways, for example:

- a rising water table, leading to water logging and salinisation
- draining of groundwater aquifers which can cause seawater intrusion
- creating of dams and canals for water storage and distribution, which can significantly alter the natural hydrology of the area
- creating higher nutrient concentration in the irrigation drainage than from non-irrigated sugar cane

Acid Sulphate Soils

When soils with a high concentration of pyritic materials are drained the sulphides in the soil are oxidised resulting in soil acidification. This can affect plant growth and the acidic material can also leach from the soil into watercourses lowering the pH to levels which will kill aquatic life. Acid sulphate soils are commonly found in coastal wetlands and mangrove areas that are increasingly cleared and drained for the cultivation of sugar cane. This has led to economic losses from crop failure, and, in extreme situations, the total degradation of aquatic ecosystems.[16 17]

Harvest time in Australia

Harvesting

Traditionally, cane fields have been burnt prior to harvesting to:

- control disease and pests
- provide a cleaner harvesting
- ease the management of fields after harvest
- simplify factory operations

Cane burning generates a lot of smoke and ash; though not a major health risk it certainly is a public nuisance. This is particularly the case in countries such as Colombia where cane is harvested all year round in an area populated by 4 million people. In response to community pressure and environmental concerns, the Colombian government decreed that all agricultural burning should be eliminated by 2005.[33] The Colombian sugar industry is now moving rapidly towards green harvesting, in which the leaves are not burnt off but cut and left in the field.

Green harvesting was initially viewed as a threat to the profitability of the sugar sector. However, it is now evident that green cane may actually have some advantages and present new opportunities for the use of cultural techniques and Integrated Pest Management. This reduces reliance on pesticides and increases yields and efficiency.[29] Most insect pests are usually controlled using biological control and competing weeds can be reduced through cultural practices. Recently there has been an increase in demand for organic sugar from western countries which is now grown in Mauritius (see *Organic sugar*).

Mauritius has little freshwater. Its annual availability of 1,550m^3 per capita compares to the UK with 2,558m^3 and the EU average of 3,575m^3. However, 45-50 million m^3 of water is taken by the sugar cane industry to process 5-6 million tonnes of cane during the milling season. This is 10% of the island's total annual water demand, and nearly equals the total annual amount of water used for domestic purposes. During the cane growing season, cane irrigation consumes nearly 70% of the daily sugar industry water usage.[30]

Impact of sugar cane industry on the Great Barrier Reef World Heritage Area

Tropical coral reefs are renowned for their abundance and diversity of marine plant and animal life. Many reefs, such as Australia's world famous Great Barrier Reef, typically lie offshore of cane growing regions with rivers discharging waters polluted with sediments, nutrients and other contaminants. Such agricultural discharge contributes significantly to the pollution of coastal waters and exposes tropical coral reefs to the following problems:[31 32]

- coral is weakened and growth is inhibited by phosphorus (P)
- increased nitrates and P concentrations promote the growth of algae which inhibit the growth of, or kill, coral polyps
- increased levels of suspended sediments (from soil erosion) excludes light and kills the corals
- chemical contaminants and nutrients attached to and transported by eroded soil particles may accumulate in aquatic organisms

Growing sugar cane in Mauritius

The sugar cane plant was introduced into Mauritius by the Dutch settlers in 1639. Sugar cane is well suited to Mauritius as it is one of the few crops which can withstand the cyclonic weather conditions of the island.[24] Sugar production reached 150,000 tonnes in 1862 from 52,000 hectares of cane. Today, around 600,000 tonnes of sugar is produced from around 72,000 hectares of cane.[25] Sugar cane now represents about 80% of cultivated land.[26] Mauritius exports more sugar cane as part of the Lomé Convention than any other African Caribbean Pacific nation with an allocation of nearly 500,000 tonnes plus 80,000 tonnes as Special Preferential Sugar (see *Subsidies that sweeten*).[27] The sugar industry employs about 20% of the nation's labour force and accounts for about one third of the export revenue (see *Europe and cane*).[28]

According to the Mauritius Sugar Research Institute, though some herbicides and insecticides are used on sugar cane, research and development has tended to encourage

sugar industry. The main advantage is that 'green' cane is fresher and results in a higher recovery of sucrose at the mill. Burning itself reduces sucrose in cane by up to 6% and the loss of sucrose under tropical conditions is 0.1% per hour during the 48 - 72 hour period after burning and cutting. With green cane there are no losses due to burning and the time between beginning the harvesting operation and milling can be reduced.[34] Green harvesting may also lead to improved management of the field. If effectively handled, residues that would otherwise be burnt, may contribute to improved soil fertility and structure, and act as mulch to reduce evaporation and weed growth.

However, green harvesting indirectly promotes the development of mechanical harvesting. As the bulk of the world's sugar cane is still harvested and loaded by hand, the move towards mechanisation could lead to high levels of unemployment in areas where the cane industry is important.[35]

Residues left in the field after green harvesting are presently considered a problem. However, apart from the potential benefits to the soil (soil retention and fertility) and to weed control, residues are also a potential source of renewable energy. For example, residues can:[36]

- be burnt directly in boilers to produce steam for turbo generators and other processes
- power gas turbines following a process of pyrolitic gasification
- be fermented to produce biogas.

It has been estimated that the residues in a one hectare field after harvest can produce the same amount of energy as about 60 barrels of oil. The sugar cane sector is conducting studies to see if there is any possibility of developing economically viable systems of producing electricity from the biomass of harvest residues.

Integrated Pest Management (IPM)

Many cane producing countries are now promoting the use of IPM techniques for cane production (see *Growing sugar cane in Mauritius*). According to its proponents IPM provides an alternative to expensive and polluting synthetic chemicals and during the 1970s the techniques encouraged a different philosophy to crop protection. This system acknowledges pests not as enemies but as indicators of inappropriate agricultural design and management systems. The concept behind IPM is to use all suitable techniques and methods in the most compatible manner possible to maintain pest populations below those causing economic injury - to manage the population rather than eradicate it. Cultural control is the most common technique and controls insect pests by manipulating the environment to render it unfavourable to the pest, or alternatively, optimal for the natural predators.[37] One example of reducing pest damage is shown in *Rodent control in Australia.*

Rodent control in Australia

Rodents are a significant sugar cane pest. By eating the cane stalks, rodents increase the risk of infection by bacteria, fungus, etc. In Australia alone, rodents have caused up to AUS$6 million losses per year to the cane industry.[38] Control of rodents has previously relied on aerial application of thallium sulphate baits, which have now been withdrawn from the Australian market. An IPM strategy involves:[39]

- knowledge of rodent feeding habits and habitat preferences
- reducing immigration to cane fields by excluding rodent-attracting weeds and reducing the area of nearby non-crop habitats available as refuges (e.g. by mowing grassy headlands, mowing or close grazing of grasslands, replacing unused grasslands with closed canopy forest, and clearing weeds from drains).
- applying a registered rodenticide (illegal if from aircraft) when the cane is short, before populations are large and damage is evident. This relies on model predictions on the number of rodents

The integration of weed control, population monitoring and strategic baiting is more complex than the previous simple strategy of aerial baiting each year following visible signs of damage. However, the advantage is that it controls the population before the damage is done, thereby increasing the crop yield.

Growing sugar beet

Sugar beet (*Beta vulgaris*) belongs to the *Chenopodiaceae* family and is grown in many temperate areas for the sugar industry. It is also grown as a fodder beet. Ideally sugar beet grows well on a rich loamy soil and a mean air temperature of 21°C during the growing season. Sugar beet is always grown as part of a carefully planned rotation with other crops such as wheat. Sugar beet is a biennial and will only flower after two years. Many other commercial crops are closely related with the same name (*Beta vulgaris*) such as swiss chard, beetroot and spinach beet.

Beet and the environment

Pesticide use

In the past thirty years sugar beet seeds have changed from a multi-germ seed (providing many shoots per seed) towards a single-germ seed (one shoot per seed). Single-germ seeds were developed to reduce the labour costs from thinning out the beet seedlings in the field,[44] which is why only a tenth of the labour force is required in a beet field compared to ten years ago (see *Sugar beet in the UK*).[45] Unfortunately each seedling needs to be protected to ensure that it produces a maximum yield. Additionally sugar beet does not compete well with weeds as the sugar beet leaves do not shade the ground for a number of weeks after planting.[47]

As a result sugar beet is sprayed very heavily with herbicides. In a survey published by the Ministry of Agriculture, Fisheries and Food (MAFF) in 1996,[48] herbicides were used on all sugar beet, insecticides used on around three-quarters and fungicides on about a third. Thirteen active ingredients were applied over the whole year of which 10.5 were herbicides. The use of such high levels of herbicides (the highest of all crops in the survey - the next highest were for peas which received under 5 active ingredients) does

Sugar beet in the UK

The UK has played an important role in the history of sugar (see *The history of sugar*). Both the beet and cane sugar industries appear to benefit the UK sugar industry which has prospered from agreements with ACP countries and the European Union (see *Subsidies that sweeten*). Just under 50% of sugar processed in the UK comes from cane sugar and the remainder from beet. Each is dominated by one company; Tate and Lyle for cane and British Sugar for beet.

Sugar beet is one of the most profitable crops for both farmers and processors, second only to potatoes (see the graph *Gross margins of UK crops*). As sugar beet is highly subsidised by the consumer, paying over double the world market price, the farmers and British Sugar are able to earn comparatively high profits. British Sugar and beet farmers also invest large amounts of money into research and development (R&D) to improve the quality and yield of sugar beet. A whole research establishment (Broom's Barn - see *Contacts*) is dedicated to improving the efficiency and profits of the sugar beet industry.

These efforts continue, despite an over-supply of sugar on the global markets and depressed prices.[40] Between 1987 and 1989 200,000 hectares were producing sugar beet with an average yield of just over 40 adjusted tonnes per hectare (adjusted for sugar content) and total production of 1.27 million tonnes. By 1998 the area had reduced by 5.5%, the yield had increased by 28% and production had increased by over 10%.[41] Meanwhile, oversupply continues and the excess sugar is dumped onto the world markets further reducing prices (see *Winners and losers*). Employment has also been reduced. Growing sugar beet today requires only 50 working hours per hectare compared to 500 working hours per hectare 30 years ago. Machinery, single-germ seeds (see *Pesticide use*) and pesticides have replaced most of the manual labour.[3]

No weeds and beet[51]						
Weed Density per metre square	**0-4**	**4-8**	**8-12**	**12-16**	**16-20**	**20-24**
Centres	31 (78%)	6 (15%)	1 (2.5%)	0 (0%)	1 (2.5%)	1 (2.5%)
Margins	34 (85%)	3 (7.5%)	1 (2.5%)	1 (2.5%)	1 (2.5%)	0 (0%)

cause problems for the local environment. A study carried out by English Nature and Morley Research Centre found that the density of weeds both in the centre of the field and along the field margins were very low. Weeds found in the centre of the field are important for the skylark (see *Birds and beet*) and yet 78% of field centres had 4 weeds or less per metre square. Weeds in field margins are important for most other species of farmland mammals and birds, yet 85% of field margins had 4 weeds or less per metre square (see the table above *No weeds and beet*).[49] The sugar industry claims it is reducing the amount of pesticides applied by treating all the seeds supplied to farmers with pesticides.[50]

Water

The risk of water pollution by nitrates has been a major concern for the sugar beet industry.[52] Consequently, farming practices are being altered to minimise the use of fertiliser without decreasing the yield of sugar. British Sugar claims to have helped its farmers cut the use of nitrogen fertiliser on sugar beet crops by 39% in the last 20 years[53] and this also helped improve the quality of sugar beet. New technology in Denmark has recently seen fertiliser application reduced from 180kg/ha to 120kg/ha. A further reduction of 30% is anticipated.[54] The rotation of beet crops with crops such as wheat, barley, and pulses, helps to retain soil nitrogen, return organic matter to the soil and to reduce the risk of disease such as root nematodes.[55 56]

During long hot summers, sugar beet also needs to be spray irrigated. In the UK, 12.9% of the spray irrigation water used in agriculture is used on sugar beet.

Harvesting and transport

Sugar beet production is highly mechanised and during harvesting has led to high levels of soil loss. Until a few years ago it was common for 20% of the weight on delivery at the processing plant to be soil. Sugar content for the same weight is between 16% and 19%, indicating that as much soil as sugar was being transported. Excessive soil imposes higher transport costs and factory expenses, as well as an indirect financial loss to the grower due to the loss of nutrients in the soil. However, recent changes to mechanical harvesting in the UK has reduced the amount of transported soil to 4-5%[57] - around 500,000 tonnes every year. As the soil cannot be returned to the farmers' fields (due to disease problems) the soil is washed, conditioned and sold for

Gross margins of UK crops 1999[43]	
Crop	**Gross Margin per hectare based on average yields (£)**
Early potatoes	£1,950
Potatoes	£1,460
Sugar beet	£1,110
Vining peas	£795
Winter oats (milling)	£575
Winter oilseed rape	£570
Winter wheat	£565
Spring wheat	£495
Spring oats (milling)	£495
Field beans (winter)	£495
Rye	£490
Linseed	£485
Winter barley	£480
Field beans (spring)	£475
Dried peas	£470
Spring barley	£460
Spring Oilseed rape	£430

Sugar in our diet

Humans and other mammals are born with a natural inclination to enjoy the sweet taste of sugar; breast milk is sweet, and so too is most ripe fruit. The consumption of these foods provides many health benefits.

This natural attraction for sugar is used by the companies that want to sell us their food products. Adding extra sugar to their processed food can make the products more palatable and attractive, especially for children. A large industry has grown up around refining sugar, taking it from its natural sources (including sugar cane and sugar beet, fruit syrups and milk sugars) and turning it into a purified food ingredient. None of the nutrients in the original source are left with the sugar - refined sugar provides energy (calories) but no vitamins or minerals or proteins - so sugar is sometimes referred to as 'empty' calories.

In defence of its use, food companies argue that sugar helps to make plain, nutritious foods such as cereals more tasty, makes sharp fruit more attractive to eat, and that sugar helps to preserve food from decay. However, nutritionists argue that sugar is used to extraordinary excess in today's food supply. Like salt, sugar is widely used to enhance the attractiveness of foods with low nutritional quality, consisting mainly of white flour and fat - such as biscuits, pastries and cakes - and sugar is the main ingredient that attracts children to sweets, chocolates, lollies and soft drinks. Sugar is also used to flavour savoury as well as sweet food such as commercially-made sauces, soups, canned pasta and canned vegetables.

Some 80% of sugar is used by manufacturers to add to processed foods.[88] It gives a huge marketing advantage to these processed and lower-nutrient foods by making them more attractive and so helping those processed

Sugar's many faces

Sugar in our food takes many forms, and may be listed on the ingredient labels of processed foods in many different ways:

- aspartame, saccharin, acesulfame, cyclamate -- the common artificial sweeteners which are not sugar at all, but commonly used intense sweetening agents that are cheap sugar substitutes. They are widely used in diet soft drinks, regular soft drinks and low-sugar sweetened products. Some concerns have been expressed over the safety of these chemicals, especially when consumed in large amounts.
- brown sugar -- a less refined form of sucrose derived from sugar cane
- corn syrup -- derived from maize starch
- dextrose -- derived from sucrose
- fructose -- found in fruits and can be made industrially from corn starch
- fruit syrups/concentrates -- derived from fruits
- glucose -- derived from sucrose or lactose
- glucose syrup -- a mixture of sucrose and more complex carbohydrates
- golden syrup -- a mix of sucrose and other sugars
- honey -- a mix of glucose and fructose, derived from plant nectar via bees
- invert sugar -- a mix of glucose and fructose
- lactose -- found in milk
- maltose -- derived from barley, found in malt extract
- maple syrup -- mainly a mix of sucrose and water
- molasses -- virtually unrefined sugar from sugar cane, with useful traces of minerals and vitamins (but this is not the best way to get those nutrients)
- sorbitol, mannitol, xylitol -- not strictly sugars, but sweet-tasting sugar-alcohols, found in seaweed, beet and wood pulp, or synthesised from sucrose and starch. They are not considered harmful to teeth and are often used in 'sugar-free' foods and foods for diabetes sufferers but they may have laxative effects.
- sucrose -- found in sugar cane and sugar beet
- sugar -- usually means sucrose, derived from cane or beet
- treacle -- less refined sucrose, with some traces of minerals.

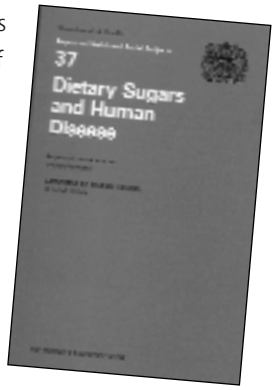
All these sweetening agents have one or more of the following properties that make nutritionists unhappy:

- they provide plenty of calories but few nutrients
- they can act in the mouth to promote tooth decay
- they make processed low-nutrient foods tasty and attractive
- they encourage a liking for sweetened food.

foods to compete against fresh and more nutritious foods. This has implications for the environment as well as for our health. Processed foods use more natural resources - in the processing itself, the packaging and the storage of these products - thus the use of sugar in processed foods adds to the environmental costs of this crop.

Sugar and disease - the evidence

A government panel of medical and nutritional scientists reviewed the role of sugar in diet for the Department of Health in 1989.[90]



They found it useful to distinguish sugars according to the source of the sugar: those sugars naturally occurring in milk, those in the cells of fruit and vegetables etc., and those that have been refined from their plant sources and are 'extrinsic' - i.e. no longer incorporated into the plant material. It was this third group - known as 'non-milk extrinsic sugars' (NME sugars) - that was found by the panel of scientists to be the main cause of problems in the diet.

Nutritional implications of sugar

Separated from their original plant or milk source, the NME sugars contain no micronutrients (vitamins and essential minerals) and provide only 'empty' calories. There are traces of nutrients in brown sugar, but the levels are too low to justify using brown sugar as a source of those nutrients. Foods with a lot of added sugars are likely to contain plenty of calories but have low levels of essential micronutrients. It follows that people who eat a sugar-rich diet may be deprived of essential vitamins and minerals. This is confirmed in surveys showing that people who get more of their calories from sugar tend to have lower levels of micronutrients in their diet than people who rely less on sugar for their calories.[91]

For example, in a survey of pre-school children, published in 1997,[92] children were divided into groups according to how much sugar and sugary food they were eating, and the nutritient intake of children eating the most and least sugar was compared. Those eating the most sugar were getting low levels of nutrients, apart from vitamin C which probably came from fortified soft drinks (see the table *The more sugar they ate, the poorer their diet*).

The high sugar eaters were eating the lowest levels of dietary fibre, suggesting they were eating little in the way of fruits and vegetables, wholegrains and pulses, and too much fatty and sugary foods.

For the survey as a whole, only 26% of the children were regularly eating citrus fruits, and only 10% ate raw carrots. In contrast, 74% of the children were regularly eating chocolates, 86% were regularly drinking sweetened soft drinks and 88% were regularly eating sweet biscuits. In terms of their nutritient intake, for the two minerals, iron and zinc, the children as a whole were falling substantially below the level generally considered adequate for a healthy diet. These minerals are found in seeds, nuts, pulses, whole grains, lean meat and green vegetables, and the implication is that sugary and fatty foods are displacing these valuable foods from the children's diets.

The more sugar they ate, the poorer their diet

	low sugar eaters (first quintile sugar consumption)	high sugar eaters (fifth quintile sugar consumption)
Vitamin B1 (thiamin)	0.9mg	0.7mg
Vitamin B2 (riboflavin)	1.4mg	1.0mg
Vitamin B3 (niacin)	17.0mg	15.0mg
Folate	136.0mcg	123.0mcg
Vitamin C	39.0mg	72.0mg
Vitamin D	2.2mcg	1.8mcg
Calcium	784.0mg	509.0mg
Iron	5.6mg	5.1mg
Zinc	5.1mg	3.7mg

from sugar will be part of the total calorie intake which, if excessive, will lead to obesity. As highly sugared foods (e.g. soft drinks, confectionery) contain little nutritional value, they can be cut from the diet without losing nutrients.

Soft drinks particularly may be associated with weight gain, as there is evidence that people do not allow for calories consumed in soft drinks as well as they do from sugary calories consumed in foods - the soft drinks are taken in addition to their normal food intake, rather than replacing it.[97] A study of children's diets and weight in the USA found that overweight children consume a greater percentage of their calories from soft drinks than normal weight children, and a second study found that children drinking sugary soft drinks consumed more calories overall than children who did not drink soft drinks.[98]

Thus current dietary advice for obese people is to reduce their calorie intake, and as sugar and sugary foods are likely to be of lower nutritional value, obese people are urged to cut sugar and sugary foods from their normal food intake, along with fat and fatty foods. For people who are overweight and in danger of becoming more so, *"restriction of sugars intake is a sensible contribution to calorie restriction".*[99]

Health claims on these snacks from Quaker (30% sugar) and Nestle (22% sugar).

Diabetes

Raised sugar in the blood (raised blood glucose levels) is a characteristic of late-onset diabetes, and it may be supposed that high levels of sugar in the diet would be a cause of this. However, epidemiological and laboratory studies have failed to show a direct cause and effect relationship. There is, though, a close link between obesity and diabetes, and to the extent that sugar contributes to excess calorie intake and may encourage or maintain obesity so it may also contribute to the development of diabetes.

In addition, excessive sugar consumption may directly increase the risk of diabetes. There is evidence that people consuming very high levels of sugar - over 200g per day -- may suffer from raised blood glucose and raised insulin levels, which are considered 'undesirable' and a possible risk factor for developing diabetes.[100] About one man in 25, and one woman in a hundred, eats this much sugar.

A person who suffers from diabetes should pay careful attention to their diet. Although sugar is a potential hazard, small amounts are now considered safe. The British Diabetic Association suggests that people suffering diabetes can eat 25g of sugar per day - about a quarter of the typical adult's current daily intake - as an acceptable part of a sensible diet.[101] The Association does not recommend purchasing special 'diabetic' foods, such as diabetic chocolate and biscuits, as these are expensive and do little to encourage healthier eating patterns.

Heart and circulation diseases

As with obesity, there is little evidence for a direct link between sugar consumption and a raised risk of heart disease, or of high blood pressure which can lead to strokes. What evidence there is suggests that excess sugar intake can raise the levels in the blood of compounds called triglycerides, especially in some

sensitive people, and that these compounds may increase the risk of heart disease.[102]

Another indirect link between sugar and heart problems, is that, as with diabetes, overweight people are at raised risk of both heart disease and strokes.

In addition, sugar is used to sweeten processed foods, and in so far as processed foods displace fresh foods such as fruits and vegetables from the diet, so sugar discourages consumption of fresh foods. Fruits and vegetables are excellent sources of various vitamins and other micronutrients, such as carotenoids, flavanoids and trace elements which can be valuable in protecting against the development of heart diseases.

Cancer

Much the same story can be told for the possible links between sugar consumption and cancer as for sugar and heart disease. There is no clear evidence linking sugar per se to any forms of cancer, although cancers of the breast are more common among overweight women and cancer of the bowel and of the colon are more common among overweight people.

As with heart disease, sweet and fatty foods may displace from the diet foods such as fruit and vegetables which contain nutrients that can help protect against cancer. Various antioxidant nutrients and trace elements found in fruits and vegetables in particular can help to reduce the risk of cancer. To the extent that sugar encourages the consumption of other foods so it reduces the nutrients in our diet which protect against cancer.

Kidney stones

There is some evidence that the formation of kidney stones may be linked to high levels of sugar in the diet, but as kidney stones are more frequent in overweight people, more research is needed to disentangle the link between obesity, sugar and kidney stones.[103]

Companies fudge the sugar issue

Healthy eating advice usually recommends eating less fat and fatty food and eating more carbohydrates. This is meant to encourage us to eat more complex carbohydrates such as cereal foods, root vegetables, pulses, and foods naturally rich in sugar such as fruit. But food companies like to blur the distinction and focus on consuming more carbohydrates generally. The nutritionist for Kellogg's cereals, for example, suggests on their packaging that all forms of carbohydrate cause dental caries, can help prevent heart disease and can help in the battle against obesity. This appears to be in contrast to the government's recommendation that cutting back on sugar intake is a sensible means of controlling calories as a means of fighting the flab.

Jacobs Vitalinea biscuits tells us on the packaging that their sugar-rich products are suitable as "*nutritious snacks*", directly contradicting health advice to reduce our consumption of sugar between meals.

Yet the same company promotes a sugar-free biscuit with the statement: "*excess sugar can cause obesity which increases your chance of getting heart disease, diabetes, hypertension, back problems and arthritis*". It seems the sugar message is selected to suit the product.

Conflicting advice from Jacob's

of view these sugars cause few problems (see above). It is the non-milk sugars that are being added to foods that are the biggest problem, and the main sources of these are in processed foods such as soft drinks and sweets (see the table *Sources of non-milk sugars*).[111]

Sources of non-milk sugars

	Adults (100% = average 25 teaspoons/day)	**Young children** (100% = average 20 teaspoons/day)
vegetables, fruits, juices	14%	10%
milk, yoghurts, milkshakes	13%	22%
sugar, jam, honey	23%	4%
soft drinks and hot beverages	17%	25%
Biscuits, cakes, pastries	12%	5%
breakfast cereals/puddings	11%	15%
Confectionery	6%	14%
Other	4%	5%

Why are we buying so much sweetened processed food?

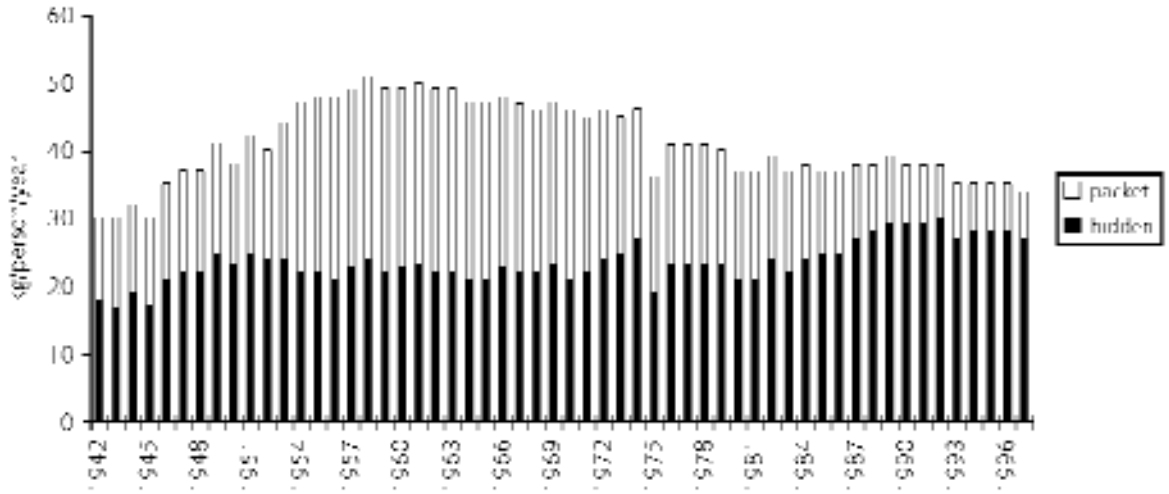
Over the last two decades we have shifted our diets towards foods which are sweeter. Out of the national shopping basket costing some £50bn each year, we now spend more on sweet foods compared with staples such as bread, margarine and milk (see the table *How we spend our shopping budgets*).[112]

One of the distinguishing features between the foods we are spending more on - such as breakfast cereals and soft drinks - and those we spending less on - such as bread and milk - is the amount of advertising they receive. Staple foods receive relatively little promotion. In contrast, food and drink companies spend heavily to advertise their sweetened products.[113]

This advertising represents a substantial proportion of all advertising, especially of the advertising directed at children. Food products dominate children's television

Our packet sugar purchases have gone down, but sugar in processed foods has gone up

(kg/person/year)



Sugar content of popular processed foods

(The target is to stay below 10-12 teaspoons per day per person)

	% sugar	grams per serving	teaspoons per serving
Breakfast cereals			
Kellogg's Frosties	38.0	11.2	2.5
Kellogg's Corn Flakes	8.0	2.4	0.5
Kellogg's Special K	17.0	5.1	1.0
Kellogg's Branflakes	22.0	6.6	1.5
Quaker Sugar Puffs	49.0	14.7	3.0
Quaker Puffed Wheat	0.3	0.1	0.0
Nestle Golden Grahams	32.0	9.6	2.0
Nestle Golden Nuggets	40.0	12.0	2.5
Nestle Shredded Wheat	0.6	0.3	0.0
Weetabix	4.7	1.8	LTH
Alpen regular	21.6	6.5	1.0
Spreads			
Hartley's strawberry jam	63.0	9.5	2.0
Robertson Golden Shred marmalade	63.0	9.5	2.0
Honey	82.0	12.0	2.0
Sun Pat peanut butter	5.3	1.0	LTH
Marmite	0.0	0.0	0.0
Nutella	55.0	8.0	1.5
Sauces			
Hellmans mayonnaise	1.2	0.2	0.0
Sharwood hot mango chutney	40.1	6.0	1.0
Heinz tomato ketchup	23.6	2.6	0.5
Kraft 1000 Island dressing	18.5	2.8	0.5
Baby foods			
Farley's Rusks	29.0	4.9	1
Farley's Low sugar rusks	21.7	3.7	0.5
Cow & Gate summer fruits drink	7.5	9.4	2.0
Heinz baby spaghetti Bolognese	2.8	4.5	1.0
Heinz baby egg custard with rice	8.9	14.5	3.0
Canned foods			
Heinz Baked Beans	6.0	12.4	2.5
Campbells Cream of Tomato Soup	5.0	15.0	3.0
HP Postman Pat spaghetti	5.5	11.3	2.5
Del Monte peaches in syrup	18.5	38.0	7.5
Del Monte peaches in juice	11.2	23.0	4.5
Ambrosia Rice Pudding	8.3	17.0	3.5
Dried foods			
Knorr tomato soup	30.2	9.7	2.0
Batchelor's minestrone Cup-a-soup	18.8	4.7	1.0
Vesta Chow Mein	12.3	22.6	4.5
Pot Noodles	6.6	5.7	1.0
Baked goods			
Kingsmill white bread medium sliced	2.7	0.6	LTH
Alinson's wholemeal bread thick sliced	2.3	1.0	LTH
Ritz crackers	6.7	0.6 (three)	LTH
Mr Kipling apple pie	27.6	18.3	3.5
Quaker Harvest Bar	30.0	6.6	1.5
Croissant	5.5	2.4	0.5
Sainsbury's Xmas pudding	50.2	50.0	10.0
McVitie's digestive biscuit	17.6	5.2 (two)	1.0

	% sugar	grams per serving	teaspoons per serving
McVitie's chocolate digestive biscuit	29.2	10.0 (two)	2.0
McVitie's Jaffa Cakes	52.0	13.0 (two)	3.0
Dairy foods			
cheese	0.1	0.1	0.0
plain milk	4.7	9.4 (glass)	2.0
plain fat free yogurt	5.4	7.6	1.5
Muller fruit corner	15.0	26.2	5.0
St Ivel Teletubbies fromage frais	14.2	12.8	2.5
Sainsbury economy ice cream	18.3	12.8	2.5
Haagen Dazs vanilla	19.7	17.7	3.5
Gulp strawberry milkshake	9.7	48.5	9.5
Confectionery			
Nestle Smarties	71.7	25.0	5.0
Nestle Kit Kat	60.2	29.3 (four fingers)	6.0
Cadburys Fruit and Nut Bar	55.7	23.0	4.5
Mars Bar	68.3	44.4	9.0
Fruit Pastilles	82.9	46.1	9.0
Soft drinks			
Coca Cola regular	10.5	35.0	7.0
Ribena regular	14.0	40.0	8.0
Ribena sparkling	13.3	43.9	9.0
Lucozade regular	17.9	61.8	12.5
Lucozade sport	6.4	32.0	6.5
Sunny Delight	9.8	49.0	10.0
Del Monte orange juice	9.7	19.4	4.0
McDonald's banana milkshake	17.7	76.3 (large)	15.0
Burger King chocolate milkshake	14.0	50.0 (small)	10.0
Hot drinks			
Horlicks	58.7	18.8	4.0
Ovaltine Light	56.7	11.3	2.5
Alcoholic drinks			
Cider	2.6	14.6	3.0
Bitter	2.3	12.9	2.5
Lager	1.5	8.4	1.5
Champagne	1.5	2.0	0.5
Red wine	0.3	0.4	LTH
Snack foods			
KP dry roast nuts	3.7	1.8	LTH
Skips prawn cocktail	7.9	1.3	LTH
Doritos	1.2	0.6	LTH
Hula Hoops crisps	0.6	0.2	0.0
Slimming foods			
Slimfast ready-to-drink	10.6	34.6	7.0
Boots Nutraslim powder	51.0	17.3	3.5
Slimfast Choc-chip bar	35.8	9.3	2.0
Batchelor's Tomato Slim-a-soup	20.0	3.9	1.0
Boots Shapers caramel bar	35.0	10.0	2.0

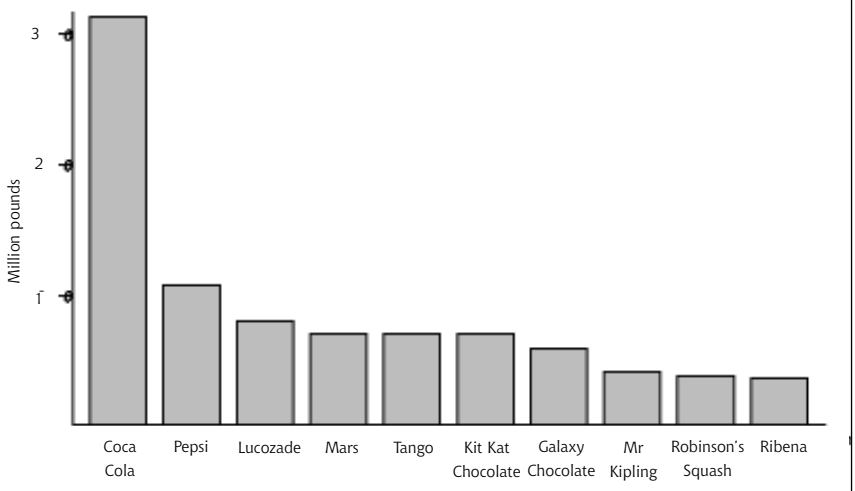
LTH = less than half a teaspoon, but more than a pinch

Coke just keeps on getting bigger!

"Perhaps the greatest threat to internal consumption comes from the anti-sugar lobby who promote fake and misleading opinions on sugar in relation to diet and health. These activists seek to reduce consumption of 'non-milk extrinsic sugars' to less than 10% of calorie intake. To achieve this would mean a reduction in consumption of approximately 25% in most developed countries, equal on an European basis to 3 million tonnes!"

Mr Clive Rutherford,
Managing Director of Tate & Lyle.[89]

Which companies spend on advertising?[114]



How we spend our shopping budgets

£billion at constant (1997) prices

	all foods	Confect-ionery	soft drinks	cakes & biscuits	breakfast cereals	bread	fats & oils	milk cheese
1985	51.0	4.5	2.8	2.4	2.0	2.6	1.7	7.3
1990	52.2	4.5	4.0	2.4	2.5	2.5	1.3	6.9
1995	51.8	4.8	3.8	2.4	2.9	2.2	1.1	6.5
1997	53.2	5.1	4.3	2.5	3.1	2.1	1.1	6.2

Subsidies that sweeten

Sugar production is one of the most heavily subsidised agricultural commodities in the world. Subsidies are used to ensure that growers receive a guaranteed market and price for sugar. The prices are always higher than the world market price to protect the countries from price fluctuations and are backed up with bi- and multi-lateral agreements. The two main regimes in place today are the United States (US) Sugar Program (*sic*) and the European Union (EU) Sugar Regime, which includes the EU - ACP Lomé Convention agreement (see *Europe and cane*). Japan also protects its sugar industry with a complex set of government policies such as price support, surcharges and tariffs. The former USSR and Eastern European countries used to have an agreement with Cuba, but this is now defunct (see *Cuban cane)*.

The United States Sugar Program

The US has protected its domestic sugar producers for the best part of the 20th century from the lower sugar prices on global markets. The domestic price of sugar has been, on average, nearly twice as high as the world price. In 1989, the US sugar quotas were successfully challenged by Australia under the rules of the General Agreement on Tariffs and Trade (GATT). The previous absolute sugar quotas were replaced with a tariff-rate quota (TRQ) system.[124] TRQs are distributed to around 40 countries. The purpose of the change was to allow imports to respond to greater demand and rise above a fixed ceiling by paying an extra duty. But the quota duty was set at a prohibitive cost - 16 cents per pound. The sugar program also offers non-recourse loans to sugar processors (18 cents per pound for raw cane sugar and 23 cents for refined beet sugar), with the sugar serving as collateral.

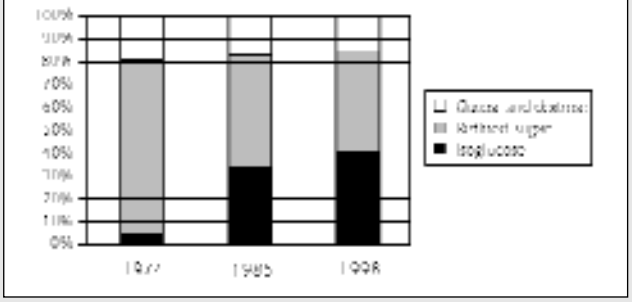
In 1996 the US implemented the Farm Bill which applied many free-market agricultural policies. However sugar was effectively left out of this legislation, contrary to many of the global free-market policies upheld by the US government. As a result there has been pressure on the government to change its policies, including by the Coalition for Sugar Reform (the coalition's objective is to bring about reform and change the US government's sugar program - see *Contacts*).

Between 1996 and 1998 US raw sugar prices averaged 22.2 cents per pound, while world raw sugar prices averaged 11.6 cents per pound.[125] In 2000 world prices are predicted to be around 5 cents per pound.[126]

Sugar from maize

Isoglucose (also known as High Fructose Corn Syrup - HFCS) is a form of sugar increasingly used for soft drinks and processing and is made from maize. Europe produces very little as it is restricted by strict quotas under the EU Sugar Regime - a maximum of 303,000 tonnes in 1997/8 equivalent to 2.5% of total EU sugar produced.[127] These quotas have been in place to protect the sugar beet growers from competition and Mediterranean countries are not allowed to swap their sugar beet quotas for isoglucose production. In the US isoglucose has been rapidly taking a larger share of the market as shown in the graph below. It is only relatively recently that it has been technically possible to 'extract' sugar from maize. Isoglucose is mainly used in sweet drinks such as Coca Cola and Pepsi though in the EU these companies still have to use the relatively expensive sugar beet. Currently in the EU only a fraction of all drinks and foods are made with isoglucose. Should the EU Sugar Regime be liberalised, it is likely that the EU would catch up with the US in its consumption of isoglucose. This would have a large impact on cane and beet producers.

US per capita sweetener consumption[128 129]



The EU Sugar Regime

The Sugar Regime was started in 1968 for European beet producers and was based on the objectives of the Common Agricultural Policy (CAP) of the Treaty of Rome. The objectives were: to increase agricultural productivity; to ensure a fair standard of living in the EU; to stabilise markets; to assure the availability of supplies; and to ensure supplies of food at reasonable prices. As Europe gets its sugar supplies from both temperate beet production and southern tropical cane producers, it has developed policies to control and underpin both types of production. In 1973 the Sugar Protocol was added to the Regime which set an institutional support system for ACP countries exporting cane sugar to Europe. Given the competition between these cane and beet producing areas, severe conflicts of interest have built up as Europe has attempted to support both European and ACP farmers (see *Europe and cane*).

The Regime uses a number of economic instruments which are all connected including: price guarantees; import and export regimes, including preferential import schemes; producer levies, and a quota system. The price guarantees required protected trade from cheaper imports and as the European intervention sugar price is relatively high, a quota system was also set up. As the quotas include a quantity to be exported, a self-financing system (producer levies) was set up to provide the funds needed to cover the export regime.

Price guarantees

The price support for sugar production is set annually using highly complex calculations, and covers both the raw materials from the farm and the refined sugar from the processor. These intervention prices guarantee that farmers receive a minimum return should world prices fall. Sugar beet farmers in Europe now benefit from a generous system of subsidies which ensure that they get a good price for their sugar which can not be undercut by cheap imports.

The quota system

Quotas are intended to avoid overproduction. Every five years the European Council sets levels of 'A' and 'B' sugar quota. The 'A' quota is set according to European demand and the 'B' quota according to special needs resulting from a shortfall in supply or increase in demand. Sugar produced outside these quotas is called 'C' quota which receives no price support and must be sold at world market prices outside of the EU. There is also a scheme to supply low cost sugar to the chemical industry. The 'A' and 'B' quota sugar, are provided in variable proportions to each Member State which are then allocated by the state to beet processors. The processors (in the case of the UK, British Sugar) then contract farmers

Cuban cane

The Cuban sugar industry has been a fascinating roller coaster of success and problems often led by the political fluctuations of the 20th Century. At the beginning of the century the USA provided a protected market for the imports of cane sugar from Cuba. After the First World War and the end of wartime controls in the USA the price of sugar skyrocketed in 1920. In the same year, Cuba made more money from sugar than that provided by all other crops from 1900 to 1914.[120] Cuba until 1959 had relied entirely on the USA to buy its sugar exports. After the 1959 revolution, the sugar industry was nationalised which expropriated both national and foreign companies. As a result the USA ceased all trade with Cuba. Cuba subsequently signed an agreement with the USSR and Eastern bloc countries which granted an assured price for Cuban sugar which reflected the cost of production rather than world prices.[121] In 1983 the USSR is said to have paid up to five times the world price for Cuban sugar.[122] Indeed the USSR supported the Cuban sugar industry throughout the Cold War period until the Soviet bloc collapsed in 1990. The previous year sugar exports accounted for over 75 percent of Cuban foreign currency earnings but by 1996 this had been reduced to less than 20 percent. In 1996, international tourism earned the most hard currency ($1.35 billion), followed by sugar ($970 million), family remittances (estimated at $500 million), and nickel ($417 million).[123]

to supply the factories with the necessary amounts of sugar beet.

The quota system has actually institutionalised a considerable level of over-production and a huge increase in Europe's share of the world sugar market. Nearly two million hectares of land were dedicated to EU beet production in 1998/9,[129a] much of it in areas unsuitable for this crop. Nearly 4 million tonnes of subsidised sugar were dumped on world markets in 1998/9. [129b]

Producer levies

To deal with the costs of exporting subsidised sugar onto the world markets, the producers are charged a levy for 'A' and 'B' sugar. These costs are split on a 60:40 ratio between producers and processors. This levy is higher for 'B' quota (39.5%) than 'A' quota (2%) as it is by its nature in excess of EU demand. In the UK 'A' and 'B' quotas are averaged out between all farmers. Surplus from 'B' sugar is bought by the member state intervention board and sold onto the world market. The state intervention board is reimbursed by the European Commission which in turn is reimbursed by the producer levies.[130] Theoretically this should ensure that the taxpayer does not pay any of the costs. In reality only around three-quarters of the export refunds are met by producer levies. In 1998 the total cost of export refunds was just under 1.7 billion Euros,[130a] which included cost of storage and processing and consumption aid. The producer levies only accounted for just under 1.2 billion Euros which left around half a billion Euros to be paid by the taxpayer via the CAP. Moreover, it is the consumer who ultimately pays for the costs of the export refunds. The consumer in Europe pays roughly double the world market price for sugar.

The simple EU sugar regime chart

Quota name	Quotas 1997/8 (million tonnes)	Price guarantees	Producer Levies	Import / Export
A - Equal to the level of European consumption (not including cane sugar imports)	12 million tonnes	Yes at intervention price	Producer levy is 2% of the intervention price	All consumed in the EU
B - An additional amount to cover unexpected shortfalls in production or increases in consumption	2.6 million tonnes	Yes at intervention price	Producer levy is 39.5% of the intervention price	Often exported as subsidised sugar on the world markets
C - Sugar produced in excess of the A and B quotas	Unlimited (in 1995/6 production was 1.6 million tonnes and in 1997/8 was 3.1 million tonnes - nearly doubling in 2 years)	None - sugar is sold at world market prices	None	All exported at world prices on the world market. The five largest markets in 1997/98 were Algeria, Syria, Israel, Iran and Russia[131]
ACP Lomé Convention agreement	Imports of around 1.3 million tonnes a year	Yes at intervention price	None - though countries have to pay for their own shipping costs	Almost 70% of imports came from Mauritius Swaziland, Guyana, Jamaica and Fiji in 98/9[132]

Jamaican sugar

When Britain joined the EU in 1973, Jamaica - as a former colony and major sugar producer - automatically came under the 'protection' of the Sugar Protocol. Yet under this protection, the economic problems of the 400 year old sugar industry were intensified. Production costs quickly rose but with a guaranteed price, the country was not encouraged to improve efficiency or add value to their product.

Over 30% of the workforce depends on the sugar sector for employment.[140] Many impoverished Jamaican villages depend completely on the sugar industry which now exports most of its cane sugar to Europe. Despite the harsh working conditions and low wages, most labourers have to work in the cane fields or sugar processing factories as there are few other opportunities for employment in rural areas dominated by cane production.

With trade negotiations hinging on the demand for Europe to reduce its protectionist policies with regard to sugar, the future looks uncertain and probably bleak for Jamaica's producers and workers. Lower sugar prices will be devastating as will the competition from increased production of alternative sweeteners (such as iso-glucose) and perhaps genetically engineered crops to produce sweeteners. The heavily indebted Jamaican economy is also unable to invest in diversifying into new crops or in the new factories and equipment required to produce more efficiently or add value to the cane crop.[139]

many local services, such as education, health, housing, transport, recreation and community services in many ACP countries. The table *How dependent?* shows the extent to which ACP countries are reliant on the sugar protocol.[135]

It has been argued that the sugar protocol has caused a high degree of export dependence and failed to stimulate economic diversification. Furthermore, there have been predictions that, should there be EU moves towards market liberalisation and reform of the CAP, "the sugar industry in most of the Caribbean states would almost certainly collapse as they would not compete on a free market".[137]

The EU has also benefited from a guaranteed supply of raw sugar cane for its EU sugar refineries (mainly Tate & Lyle - see *Tate & Lyle*).[138] However with sugar prices at their lowest for 14 years the subsidies to the ACP countries are proving expensive. Additionally, as more Eastern European countries continue to apply to join the EU the amount of sugar beet produced may increase, further reducing Europe's need for cane sugar.

The Sugar Protocol and Sugar Regime maintain high production even in areas where it is uneconomic or unsuitable to produce sugar. They also ensure that the effect of changes in supply and demand are concentrated on a very small market which amounts to only about one fifth of world production. This keeps the world price low in the long term but subject to severe fluctuations which can be extremely damaging to poor countries relying on this traditional export crop.

World trade in sugar

With the establishment of the World Trade Organisation (WTO) during the 1990s all the protected sugar markets are under threat. The US in particular is under pressure to change its policies to bring the trade into line with other agricultural commodities.

Demand for reform of the Sugar Regime has also been growing, especially over the past decade. New trade terms agreed in 1992 under the General Agreement on Tariffs and Trade (GATT) did ensure some reform of the European policy. However, the final negotiations considerably watered down the original reform proposals. Obligations to reduce import tariffs (European barriers to trade) were severely weakened as were limits to expenditure on export subsidies. The effect of the GATT on the sugar market has so far been minimal and on poor countries negligible or even negative. Subsidies on sugar are still very high in Europe. In the first half of 1999, EU subsidies on exports of sugar, isoglucose and inulin were over 500 Euros per tonne, more than three times world prices.[141] The European Court of Auditors concluded that the Sugar Regime can not be justified saying that *'After 22 years of common organisation of the markets in the sugar sector, it must be concluded that the experiment of organising these markets on a community basis has failed'*.[142] Despite this and with an increasing level of criticism from other world sugar producers, the Regime was renewed in 1995 almost unchanged until 2001.[143]

Tate and Lyle

Tate and Lyle is Europe's major cane sugar importer, with nearly all the preferential sugar coming into the European Union being processed at the Thames Refinery in London, the largest sugar refinery in the world. Tate and Lyle is completely vertically integrated in that they have interests in shipping, storage, processing, refining and distribution of cane sugar. Tate and Lyle also provide the link between cane producing ACP countries and European consumers.

Winners and losers

Non-ACP poor countries: generally the losers

The countries that have really suffered from both the EU Sugar Regime and the US Sugar Program are the non-ACP poor economies which depend on the sugar trade. World sugar prices are much lower due to subsidised exports from the EU and restricted markets. According to the United States Department of Agriculture the price of sugar in the 1970s and 1980s would have been 10% to 30% higher in the absence of sugar quotas.[144] Another study found that world sugar prices may rise between 5% and 41% depending on the extent of market liberalisation.[145] The same report states that *"Increased world prices for sugar, would benefit producers, particularly those in lower cost producing countries, many of which are developing economies that currently sell much of their output at artificially low prices because of market distortions. Liberalisation of the US market alone would benefit world sugar exporters by about US$1.5 billion a year".*

Over 12 million people are employed in cane sugar production in poor countries, mostly on plantations, but also as independent farmers. Sugar workers not under a preferential economic arrangement (such as the Sugar Protocol in the Lomé Convention) are vulnerable to periods of low or zero income when either the price of sugar falls or during low employment periods. Conditions for workers on plantations tend to be particularly bad as there is little access to land to grow their own food. Plantations are hangovers from European colonial rule (see *History of sugar*) and still today provide appalling conditions for the workers, for example. Growing, and in particular harvesting, sugar cane is hard and unpleasant work, often providing a meagre income, especially if the sugar cane does not receive a preferential price.

ACP countries: arguably the winners

For the ACP countries under the Lomé Convention, sugar has become a vital component of their national economies. Dr Arvin Boolell, a Mauritius Minister for Agriculture and Natural Resources once said *"Sugar is the very lifeblood of our economies and the most important pillar of our societies".*[146] The sugar industry is a significant employer of labour in most ACP countries with more than a quarter of a million people directly employed. In some countries, this is equal to 80 - 85% of total agricultural employment[147] (see Growing sugar *cane in Mauritius* and *Europe and cane).*

Western consumers: the losers

Most of the funds for protecting the European and ACP sugar markets come from the consumer. With prices for sugar anything between double and five times the world market price, it is the consumer who pays the extra amount. One Australian study estimated that EU consumers could save an estimated US$2.2 billion a year from an approximate 40% reduction in white sugar intervention price by 2005. This would also provide a net gain to the EU economy of around US$580 million.[148] However lower prices for sugar may also encourage increased consumption (see *Sugar and health*).

The environment: loser and winner

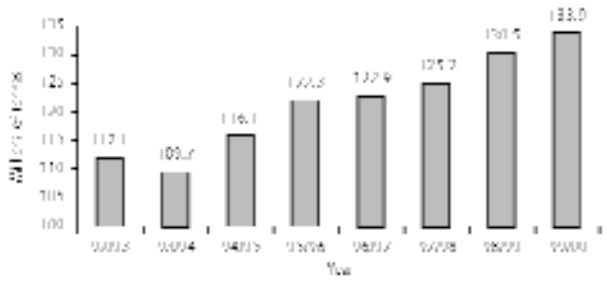
Often the current market distortions encourage sugar growing in environments not suited to the crop. European sugar beet is now grown in many Mediterranean countries to make use of the EU quota system. For example Portugal now grows sugar beet though it had never grown sugar beet before joining the EU. The US Sugar Program has been held responsible for the destruction of some of the Florida Everglades, a sensitive and unique ecological area. Since the 1960s, sugar production in the area has increased from over 20,000 hectares to over 180,000 hectares. The Everglades National Park has been polluted with phosphorous and the barrier coral reef system in Florida Bay has been damaged (see *Growing sugar cane*).[149] However the subsidies have also provided some benefits for the environment in the UK (see *Growing sugar beet*)

and provided the resources for many ACP countries, such as in Mauritius, to fund research and development into sustainable production (see *Growing sugar cane*).

Sugar producers in Europe and the US: the winners

Producers and processors of sugar beet in the EU are the clear winners under the current EU Sugar Regime - sometimes ensuring prices in excess of five times world market prices. Sugar beet is one of the most lucrative crops to grow for UK farmers, with a guaranteed income often much higher than other arable crops within the same rotation.

Production of raw sugar (world)



Oversupply continues

At the time of writing (2000) the world over-supply of sugar was continuing. F.O. Licht, a sugar analysis firm, has projected that world sugar production would total 134.7 million tons in 1999-2000, while consumption would be only 126.7 million tons.[150] This is an increase of over 3% over 1998/99 and the sixth consecutive year of growth so that global sugar production has increased by 22 percent (see *Production of raw sugar*).[151]

The most significant increase has come from Brazil which accounted for 28% of the increase in world production and 75% of the increase in exports 1993/4 to 1999/2000. Brazil now has 26% of world trade compared with 14% in 1993/4. Brazil's domination of the world raw sugar market is due to the relatively low production costs and its alcohol sector acting as an important alternative outlet for cane. It is assumed that Brazil's dominance of the sugar market will continue.[152] For an overview of the global sugar trade in 2000 see *Global outlook.*

Global outlook

Country	Production estimated 1999/2000 million tonnes	Increase / decrease (1 year)	Exports / Imports
USA	8.1	+6%	Exports = 159,000 tonnes Imports (TRQ) = 1.14 million tonnes
Mexico	5.2	+4%	Exports = 900,000 tonnes
Cuba	4.1	+8%	Exports = 3 million tonnes
Brazil	19.2	+5%	9.7 million tonnes
EU	18.7	+5%	Exports = 6.1 million tonnes (an increase of 16%!) Imports = 1.9 million tonnes (1.3 = preferential imports)
India	18.4	+6%	Imports = -80% (200,000 tonnes)
Thailand	5.8	+7%	Exports = 3.4 million tonnes (+6%)
Australia	5.4	+10%	Exports = 4.2 million tonnes (+12%)

Sustain: The alliance for better food and farming

Sustain

The alliance for better food and farming

Our Work
To represent over 100 national public interest organisations working at international, national, regional and local level.

Our Aim
To advocate food and agriculture policies and practices that enhance the health and welfare of people and animals, improve the working and living environment, promote equity and enrich society and culture.

Please note
The views expressed in this publication are not necessarily those of the working party members, of anyone acknowledged, or of Sustain's membership, individually or collectively.

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