sugarcane

plant

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Also known as: Saccharum officinarum

Takeo Yamane | Britannica Editors | Nov. 15, 2025 • History

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sugarcane Sugarcane (*Saccharum*).

News • Sugarcane price fixed at ₹2,900 per tonne in Bidar • Nov. 13, 2025, 4:11 AM ET (The Hindu)

sugarcane, (*Saccharum officinarum*), perennial grass of the family Poaceae, primarily cultivated for its juice from which sugar is processed. Most of the world's sugarcane is grown in subtropical and tropical areas. The plant is also grown for biofuel production, especially in Brazil, as the canes can be used directly to produce ethyl alcohol (ethanol). The by-products from cane sugar processing, namely the straw and bagasse (cane fibres), can be used to produce cellulosic ethanol, a second-generation biofuel. Other sugarcane products include molasses, rum, and cachaça (a Brazilian alcohol), and the plant itself can be used as thatch and as livestock fodder. This article treats the cultivation of the sugarcane plant. For information on the processing of cane sugar and the history of its use, *see* sugar.

The sugarcane plant produces a number of stalks that reach 3 to 7 metres (10 to 24 feet) high and bear long sword-shaped leaves. The stalks are composed of many segments, and at each joint there is a bud. When the cane becomes mature, a growing point at the upper end of the stalk develops into a slender arrow bearing a tassel of tiny flowers.

Culture

sugarcane field Field of sugarcane (*Saccharum officinarum*) in St. George Parish, Barbados.

Sugarcane is propagated primarily by the planting of cuttings. The sections of the stalk of immature cane used for planting are known as seed cane, or cane sets, and have two or more buds (eyes), usually three. Seed cane is planted in well-worked fields. Mechanical planters that open the furrow, fertilize, drop the seed cane, and cover it with soil are widely used.

Seed cane is spaced 1.4 to 1.8 metres (4.5 to 6 feet) apart at densities 10,000 to 25,000 per hectare (4,000 to 10,000 per acre). Under favourable conditions, each bud germinates and produces a primary shoot. Root bands adjacent to each bud give rise to a large number of roots, and each young shoot develops its own root system. Tillering, or sprouting at the base of the plant, takes place, and each original seed cane develops into a number of growing canes, forming a stool. The plant crop is obtained from these stools.

Another method of cane propagation is by ratooning, in which, when the cane is harvested, a portion of stalk is left underground to give rise to a succeeding growth of cane, the ratoon or stubble crop. The ratooning process is usually repeated three times so that three economical crops are taken from one original planting. The yield of ratoon crops decreases after each cycle, and at the end of the last economical cycle all stumps are plowed out and the field is replanted.

Sugarcane is grown in various kinds of soils, such as red volcanic soils and alluvial soils of rivers. The ideal soil is a mixture of sand, silt, and clay particles, with a measure of organic material. The land is plowed and left to weather for a time before subsoiling (stirring up the subsoil) is carried out. The crop demands a well-drained soil, and drains—on the surface, underground, or both—are provided according to the topographic conditions of the fields.

To attain good yields, sugarcane requires 2,000 to 2,300 mm (80 to 90 inches) of water during the growing period. When precipitation is deficient, irrigation, either by spraying or by applying water in furrows, can make up for the deficiency. The growth period for cane crops varies considerably

according to the region: 8–9 months in Louisiana, U.S.; 15 months in Australia and Taiwan; 18–22 months in Hawaii, South Africa, and Peru. The lowest temperature for good cane-plant growth is about 20 °C (68 °F). Continuous cooler temperature promotes the maturation of cane, as does withholding water. Harvesting and milling begin in the dry, relatively cool season of the year and last for five to six months.

Fertilizers are applied to sugarcane from the beginning of planting through the whole growth cycle but not during the ripening period. Optimum amounts of fertilizers (nitrogen, phosphorus, and potassium) vary greatly with soil types, climatic conditions, and the kind and length of the growing cycle.

To secure a good crop, weeds in the cane fields must be attacked until the cane stools develop a good canopy, which checks weed growth. Weeding, still largely manual, is done with a hoe, though mechanical cane weeders with attached rakes have been developed. Chemical herbicides are widely used.

The mature cane is harvested by both manual and mechanical means. Some mechanical harvesters are able to sever and discard the tops of erect crops and cut cane stalks, which are delivered into a bin trailer for transport to the mill by tractor or light railway wagon.

Key People: Jean Étienne de Boré

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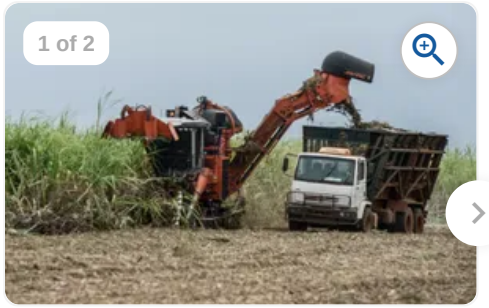

sugarcane harvesting A cutting machine on a plantation in São José do Rio Prêto, Brazil, harvesting sugarcane, the prima...(more)

Diseases

The sugarcane plant is subject to many diseases. Sereh, a blackening and degeneration of the fanlike tops, is caused by an East Indian virus. Mosaic, which causes mottling or spotting of foliage and sometimes curling, dwarfing, and narrowing of the leaves, is due to infection by any of several viruses. Red rot (important in Indonesia and South Asia) is characterized by interrupted red and white patches within the cane along with a sour alcoholic odour when the cane is split open. Caused by the fungus *Colletotrichum falcatum* (*Glomerella tucumanensis*), red rot first attracts attention by a yellowing and withering of the leaf, and eventually the entire plant dies. Gumming disease (important in New South Wales, Australia) is characterized by gummosis, the pathological production of gummy exudates as a result of cell degeneration; it is caused by the bacterium *Xanthomonas vasculorum*. Fiji disease, a virus disease first reported from the Fiji islands, is characterized by elongated white to brown swellings on the underside of the leaves, followed by stunting and death. Leaf scald is a vascular disease caused by the bacterium *Xanthomonas albilineans*, characterized by creamy or grayish streaking and later withering of the leaves. Eyespot, characterized by yellowish oval lesions on leaves and stems, is a disease caused by the fungus *Helminthosporium sacchari*. Epidemics of these diseases have been checked by replacing the susceptible varieties of cane with varieties resistant to the disease.

Pests

Sugarcane is attacked and damaged by various insect pests that bore into and feed on the different parts of the plant. Control measures include biological control by parasites or predators, chemical control by insecticides, and the introduction of resistant cane varieties.

The moth borer, *Diatraea saccharalis*, which is widely distributed throughout cane-growing areas, is capable of causing extensive damage when out of control. The sugarcane leafhopper and the anomala grub yielded to biological control in Hawaii when other measures were unsuccessful. Various predator animals live on insects destructive to the sugarcane. For example, in Queensland, Australia, the bandicoot, an insectivorous marsupial, is a diligent destroyer of white grubs.

The insect pest responsible for some of the greatest crop losses is the grayback beetle in its larval stage. Effective grub control is obtained by applying the insecticide benzene hexachloride after the young cane plant has germinated and stooled, though this chemical has been banned in many countries. Sugarcane can be protected against wireworms by applying insecticides when cane sets are planted. Rats, which destroy part of the stalk, are controlled by poisoning and trapping.

Breeding

Sugarecane was originally cultivated by natives of southern Pacific islands. Most present-day commercial canes are the offsprings or hybrids directly descended from the Cheribon cane (*Saccharum officinarum*), a Javan noble cane which was developed from a wild cane species, *S. robustom*. Noble canes, which represent the highest development of the species, are characterized by thick barrel-shaped internodes, or segments; large soft-rinded juicy stalks; and high sugar content.

sugarcane Sugarcane (*Saccharum officinarum*).

The purpose of sugarcane breeding is to produce new hybrid varieties that will be immune, or resistant, to diseases and insect pests and will increase the production of sugar per unit area, yielding canes of higher sugar content and better fabrication qualities. Many of the original noble canes were susceptible to some serious diseases, but their hybridization with wild canes has improved their hardiness. For example, the wild cane *S. spontaneum* contains little sugar, and it is immune to most diseases; it has been used extensively by breeders to improve commercial varieties.

The first task of breeding is to obtain new cane seeds by sexually crossing selected parent varieties and then to select seedlings from the new seeds. The crossing is effected by enclosing in a cloth lantern two flower tassels from two different cane varieties selected as a male and a female parent. The commercially superior varieties are not necessarily ideal parents. Many of the best varieties were bred from parents unsuitable for commercial use. The production of such cane seeds and seedlings by crossbreeding has been established in Java and Barbados since the 1880s.

A selected seedling is planted and tested in the fields, and usually takes up to 10 years before being released as a new commercial variety.

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The Editors of Encyclopaedia Britannica

Entertainment & Pop Culture › Food

sugar

chemical compound

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Sugarcane Lines of sugarcane before harvest.

Top Questions

- What is sugar and why is it considered a chemical compound?
- What are the different types of sugars, and how do they differ chemically?
- How do the chemical structures of sugars impact their taste and function?
- How does the body process sugar on a chemical level?

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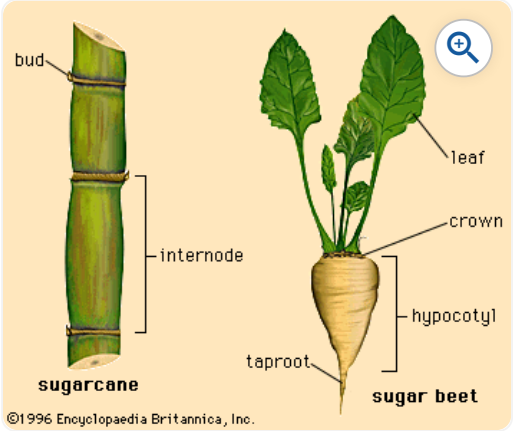
sugar, any of numerous sweet, colourless, water-soluble compounds present in the sap of seed plants and the milk of mammals and making up the simplest group of carbohydrates. The most common sugar is sucrose, a crystalline tabletop and industrial sweetener used in foods and beverages.

As a chemical term, “sugar” usually refers to all carbohydrates of the general formula $C_n(H_2O)_n$. Sucrose is a disaccharide, or double sugar, being composed of one molecule of glucose linked to one molecule of fructose. Because one molecule of water (H_2O) is lost in the condensation reaction linking glucose to fructose, sucrose is represented by the formula $C_{12}H_{22}O_{11}$ (following the general formula $C_n[H_2O]_{n-1}$).

Sucrose is found in almost all plants, but it occurs at concentrations high enough for economic recovery only in sugarcane (*Saccharum officinarum*) and sugar beets (*Beta vulgaris*). The former is a giant grass growing in tropical and subtropical areas; the latter is a root crop growing in temperate zones. Sugarcane ranges from 7 to 18 percent sugar by weight, while sugar beets are from 8 to 22 percent sugar by weight. Sucrose from either source (or from two relatively minor sources, the sugar maple tree and the date palm) is the same molecule, yielding 3.94 calories per gram as do all carbohydrates. Differences in sugar products come from other components isolated with sucrose.

The first cultivated sugar crop was sugarcane, developed from wild varieties in the East Indies—probably New Guinea. The sugar beet was developed as a crop in Europe in the 19th century during the Napoleonic Wars, when France sought an alternate homegrown source of sugar in order to save its ships from running blockades to sugarcane sources in the Caribbean. Sugarcane, once harvested, cannot be stored because of sucrose decomposition. For this reason, cane sugar is generally produced in two stages, manufacture of raw sugar taking place in the cane-growing areas and refining into food products occurring in the sugar-consuming countries. Sugar beets, on the other hand, can be stored and are therefore generally processed in one stage into white sugar.



Sugar crops Structures of the sugarcane (left) and sugar beet (right).

Key People: Sir Norman Haworth • Hans von Euler-Chelpin

Related Topics: white sugar • invert sugar • cane sugar • mother liquor • raw sugar

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Cane sugar

Cane harvesting and delivery

Sugarcane is generally harvested in the cooler months of the year, although it is harvested year-round in Cuba, the Philippines, Colombia, and other prime areas. As much as two-thirds of the world's cane crop is harvested by hand, using long machetes. Since the 1940s, however, mechanical harvesting has increased. Before or after harvest, the cane is burned in order to drive out rodents and snakes and to burn off leaves and trash that dull knife blades, but environmental considerations are leading to the harvesting of whole unburned cane in several areas.

Harvested cane is transported to the factory by many means, ranging from manual haulage to oxcarts, trucks, railway cars, or barges. The usual economic distance between field and factory is 25 km (15 miles). Minimizing the time between cutting and processing reduces the amount of cane deterioration and encourages a higher sugar yield.

Upon arrival at the factory gate, cane is weighed and sampled for analysis (if factors other than weight are used for payment). Cane is stored in as small amounts and for as short a time as possible in the mill yard. Factories run around the clock, stopping in some areas for only one or two days per month for cleaning. Although payment is usually based on weight and sucrose content, quality factors such as moisture, trash, and fibre content also are included. Payment is generally split, with 60 to 65 percent going to the grower and 35 to 40 percent going to the processor.

Raw sugar manufacture

Sugarcane processing is practiced in many variations, but the essential process consists of the following steps: extraction of the cane juice by milling or diffusion, clarification of the juice, concentration of the juice to syrup by evaporation, crystallization of sugar from the syrup, and separation and drying of the crystals.

Juice extraction

After weighing, sugarcane is loaded by hand or crane onto a moving table. The table carries the cane into one or two sets of revolving knives, which chop the cane into chips in order to expose the tissue and open the cell structure, thus readying the material for efficient extraction of the juice. Frequently, knives are followed by a shredder, which breaks the chips into shreds for finer cane preparation. The chipped (and shredded) cane then goes through the crusher, a set of roller mills in which the cane cells are crushed and juice extracted. As the crushed cane proceeds through a series of up to eight four-roll mills, it is forced against a countercurrent of water known as water of maceration or imbibition. Streams of juice extracted from the cane, mixed with maceration water from all mills, are combined into a mixed juice called dilute juice. Juice from the last mill in the series (which does not receive a current of maceration water) is called residual juice.

The alternative to extraction by milling is extraction by diffusion. In this process, cane prepared by rotating knives and a shredder is moved through a multicell, countercurrent diffuser. Extraction of sugar is higher by diffusion (an average rate of 93 percent, compared with 85–90 percent by milling), but extraction of nonsugars is also higher. Diffusion, therefore, is most used where cane quality is highest—e.g., in South Africa, Australia, and Hawaii. Occasionally a smaller “bagasse diffuser” is used in order to increase extraction from partially milled cane after two or three mills. (Residual cane fibre, after juice is removed, is called bagasse.)

bagasse

Disposal of the large amounts of water used by diffusers is a costly environmental problem, as cane factories that practice diffusion must operate their own primary, secondary, and tertiary water-treatment systems.

Clarification

Mixed juice from the extraction mills or diffuser is purified by addition of heat, lime, and flocculation aids. The lime is a suspension of calcium hydroxide, often in a sucrose solution, which forms a calcium saccharate compound. The heat and lime kill enzymes in the juice and increase pH from a natural acid level of 5.0–6.5 to a neutral pH. Control of pH is important throughout sugar manufacture because sucrose inverts, or hydrolyzes, to its components glucose and fructose at acid pH (less than 7.0), and all three sugars decompose quickly at high pH (greater than 11.5).

Heated to 99–104 °C (210–220 °F), the neutralized juice is inoculated, if necessary, with flocculants such as polyacrylamides and pumped to a continuous clarification vessel, a large, enclosed, heated tank in which clear juice flows off the upper part while muds settle below. This settling and separation process is known as defecation. Muds are pumped to rotary vacuum filters, where residual sucrose is washed out with a water spray on a rotating filter. Clarified juice, meanwhile, is pumped to a series of three to five multiple-effect evaporators.

Concentration

In the multiple-effect system, developed for the American sugar industry in 1843, steam is used to heat the first of a series of evaporators. The juice is boiled and drawn to the next evaporator, which is heated by vapour from the first evaporator. The process continues through the series until the clarified juice, which consists of 10–15 percent sucrose, is concentrated to evaporator syrup, consisting of 55–59 percent sucrose and 60–65 percent

by weight total solids. Nonsugars deposit on the walls and tubes of the evaporators, creating scale deposits and reducing the efficiency of heat transfer. Scale removal often forces the entire factory operation to shut down if another set of evaporators is not available.