Organic cultivation of sugar cane

Saccharum officinarum L.

Sugarcane (Saccharum officinarum) is a tropical grass native to Asia where it has been grown for over 4,000 years. By 400 BC, methods for manufacturing sugar from sugarcane had been developed in India. Europeans were introduced to sugar during the Crusades. By the 11th century AD, sugar was being imported throughout Europe. Christopher Columbus likely brought the plant to the West Indies. Today, over 75 percent of the world's sugar comes from sugarcane.

Sugarcane was one of the first "cash crops" of early colonial America. It grew plentifully in the southern states and was a major source of income for many plantations. High labor costs in the United States led to the industry's rapid conversion to mechanical harvesting in the early 1990s.

- **Genetically, sugar cane (*Saccharum officinarum*) originates from New Guinea. The plant belongs to the Gramineae (grasses) family.**

- **Sugar cane is a C4 plant with a high rate of photosynthesis (its rate lies around 150-200% above the average for other plants). It is a perennial crop with a high self-tolerance.**

- **The plant tillers 4-12 stems, depending on the variety and site conditions, which can grow to between 3 and 5 meters in height. The sugar content (saccharose) fluctuates between 11% and 16%.**

Varieties and countries of origin

- **Sugar cane only rarely produces seeds capable of germination. Most of the several hundred usable clones are cross-fertilizations between *S. officinarum* (high sugar content), *S. sinensis* (adaptable), *S. spontaneum* and *S. robustum* (disease resistant).**

- **The production of sugar cane for home consumption on small farms is wide-spread in many regions of Asia and Latin America. Large scale cultivation of sugar cane, though, is only possible in combination with commercial or industrial processing.**

- **The most important producing countries of organic cane sugar are currently Brazil, Paraguay, Philippines, USA, Mauritius and the Dominican Republic.**


Cane
growing
areas

Uses and contents

- **Sugar cane is chewed in all of the producing countries because of its sweet cell juice. Sugar cane juice is obtained by pressing the sugar canes, and is mostly used to sweeten foodstuffs, but can also be consumed as fresh or fermented juice.**

- **Many producers also offer molasses (thickened sugar cane juice) and alcohol (a byproduct of sugar processing) in organic quality.**
- **Organic alcohol is used in the manufacture of cosmetic and pharmaceutical products.**

Aspects of cultivation

- **Organic sugar cane is mostly cultivated on small farms of 0.1-3 ha.**
- **The work is carried out manually, or with the help of animals.**
- **Only ripe sugar cane is cut down during the harvest. Cut off leaves and unripe plants are left on the plot.**
- **In this way, the field is never cleared, and soil is constantly covered by a thick layer of mulch.**
- **Such systems make sustainable cultivation of sugar cane possible, also on relatively sloping ground.**

Site requirements

- **Sugar cane is a very adaptable crop that is grown between latitude 37° North and latitude 31° South.**
- **Good site conditions are necessary for successful organic cultivation. Under natural conditions, the plant seeks its place in an eco-system amongst the canopy, and therefore needs to reach above the additional crops.**
- **Relatively wet conditions on organic cultivation systems tend to cause more difficulties than do sites that are too dry.**

- **This due to a more involved mechanical tilling of weeds, and also to the difficulties the shoots have in developing.**

- **Ideal site conditions are met with average temperatures of 20-28ºC and little fluctuation between night and day.**

- **The ideal amount of rainfall is around 1700 mm, whereby a drought occurring during harvesting is perfect. The soil should be deep, humus-rich, well-aerated and drained.**

Seeds and seedlings

- **In principle, recommended varieties for organic sugar cane cultivation are those that have proven themselves under the prevalent climatic conditions on site. Sugar cane is an intensely bred crop. Varieties are available that are resistant against the most important pests and diseases.**

- **Seedlings must come from organic nursery fields (own, or from specialized institutes).**

- **In contrast to perennial field cultivation of sugar cane, the nursery fields need to undertake a strict regimen of crop rotation, in order to prevent infestation by soil-borne diseases and pests, such as, e.g., nematodes, sugar cane smut and Red rot .**

- **Seedlings** are taken from unripe sugar cane, whereby the cane is cut into 30 cm pieces. The use of seedlings stemming from conventional nurseries which have been treated with chemical dressing preparations is not permitted.


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Planting methods

- **Establishment of new crops**
- **The seedlings are planted in rows in pre-prepared furrows (furrow depth ca. 40 cm).**
- **On conventional sugar cane cultivations, the average distance between the rows is 150 cm (120 cm - 180 cm)..**


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- **On organic sugar cane cultivations, the best results have been achieved with double rows (40-50 cm gap between two single rows and 110- 180 cm distance to the next double row). It is necessary to plant legumes on newly developing organic plantations**

- **The broad middle gap between the rows of new plantations is for the sowing of legumes.**
- **On farms with enough labour available for the manual harvest, these can be beans (*Phaseolus vulgaris* in drier, and *Vigna spp.* in wetter regions), which, in addition to supplying nitrogen, are also an important source of food, and therefore useful to the economics of the plantation.**

- **Care must be taken during the bean harvest to leave the entire foliage of the bean plants in the middle row. Sugar cane will then be planted in precisely this row during the next season.**

Supplying nutrients and organic fertilization management

Nutrient requirements:

- **On organic sugar cane cultivations, it makes no sense to strive for maximum yields of 200 t or more of foliage per ha. Depending on the site, an organic sugar cane plot can deliver optimum yields of between 45 t and 120 t of foliage.**


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- **When the correct variety is chosen, and with a legume variety that is easy to combine, a good 80% of the N-requirements can be reduced within the cultivation system. Sugar cane possesses efficient endo-mycorrhizae which can supply an additional source of phosphorous.**

- **Free-living N_2-bacteria in the rhizosphere can provide an additional supply of nitrogen. The use of organic fertilizer should not be for more than 20% of requirements. The supply of potassium and other nutrients must be established by mobilizing soil reserves and the application of organic fertilizer.**

- **Intercropping sugar cane with beans (*Phaseolus vulgaris* in drier, and *Vigna spp.* in wetter regions), which, in addition to supplying nitrogen**

- **Sugar cane biogases has a C/N ratio of around 150, and therefore needs a source of nitrogen to be composted. As a rule, chicken or cattle dung is used. Hereby, it is essential that the dung does not come from conventional large-scale livestock farming.**

- **The ash resulting from the burning of biogases should also be composted. Additions of rock phosphates, sulphur and ripe compost have proven their worth as starters. Under certain circumstances, it may make sense to infect the compost subsoil with no symbiotic N-fixers.**

Burning off and mulching

Organic sugar cane cultivation consciously rejects the burning-off method in favor of a "green harvest" for the following reasons:

- **· The sugar cane biomass remaining after harvesting is the basis for long-term sugar cane cultivation.**
- **· Mulch encourages N-fixing, from independent and symbiotic N-fixers.**

- **Mulch suppresses unwanted growth.**
- **In combination with the measures outlined above, this method serves to improve the humus content and die structure of the soil.**
- **High nutrient and energy loss is caused by carbon and nitrogen compound gases escaping.**

Biological methods of plant protection

- Diseases and pests

Weed management

On organic sugar cane cultivations, weeds are mainly controlled by the following factors:

1. · By the competitiveness of the sugar cane itself;
2. · By the large amount of foliage left out in the field after harvesting;
3. · By sowing in the in-between rows;

- **Through mechanical equipment pulled either by machine or animal;**
- **· Through manual intervention;**
- **· Although burning is possible, it makes little sense, and is only practicable on new cultivations, because during growth, the mulch material can easily catch fire and there is also a great loss of organic substances.**

Harvest and post harvest treatment

- **Harvesting begins when the leaves turn yellow (or when the optimum sugar content of 15% has been reached, that can be tested in the field with a refractometer).**
- **Very different kinds of techniques are used for organic sugar cane depending on the country and local conditions,**

- **(from automated combine harvesters, to cutting by hand and transport via ox and cart). Sugar cane is still widely cut by hand (machete), whereby the stem is cut down close to the soil. The cane tip and leaves are then also cut away.**

Mechanized harvest of sugarcane

Storage

- **Because whole cane sugar is very hygroscopic (draws water), it should be stored.**
- **air-tight in a dry place. When the product is incorrectly stored, yeasts may begin a**
- **fermentation process. Under ideal storage conditions (dry, dark and no smells),**
- **whole cane sugar can be stored for 12-18 months.**


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