



Learn about the plants that sweeten our world

Cell Phone Tour

at The Frelinghuysen Arboretum

353 East Hanover Avenue • Morris Township, NJ 07962

In this bed, grow trees, shrubs, herbs, and vegetables. These plants come from arid deserts, steaming tropics, temperate forests, and mountain fields.

What do they all have in common? All the plants grown here provide us with sweeteners! Sweeteners for our beverages, baking, ice cream, and candies all come from plants. But what exactly is “sweet?”

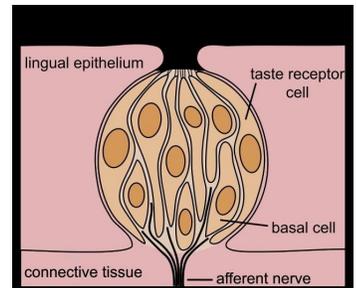
Taste is one of the five senses, including sight, sound, smell, touch, and taste. Taste is the sensation produced when a substance in the mouth reacts chemically with taste receptor cells located on taste buds. Humans have taste receptors on taste buds and other areas including the upper surface of the tongue.

The tongue is covered with thousands of small bumps called papillae, which are easily visible to the naked eye. Within each papilla are hundreds of taste

buds. There are between 2000 and 5000 taste buds that are located on the back and front of the tongue. Each taste bud contains 50 to 100 taste receptor cells.

Taste is brought from the taste receptor cells to the brain by 3 different cranial nerves. At least two different variants of the "sweetness receptors" must be activated for the brain to register sweetness.

Currently, science recognizes 5 tastes: sweet, sour, salty, bitter, and unami, or astringent. Taste buds are able to differentiate among different tastes through detecting interaction with different molecules or ions.



How to enjoy this Cell Phone Tour

Dial 973.975.0973 for the Introduction and Instructions. Then, use your keypad to press the following “stops” for specific plant information.

- | | | |
|----|------------------|------------------------------|
| #1 | Stevia | <i>Stevia rebaudiana</i> |
| #2 | Aztec Sweet Herb | <i>Lippia dulcis</i> |
| #3 | Corn | <i>Zea mays</i> |
| #4 | Agave | Agave |
| #5 | Miracle Fruit | <i>Synsepalum dulcificum</i> |
| #6 | Sugar Maple | <i>Acer saccharum</i> |
| #7 | Sugar | <i>Saccharum officinarum</i> |
| #8 | Sorghum | <i>Sorghum bicolor</i> |

When you have finished listening, ask yourself this question: What popular sweetener *is not* growing here?

Here are some hints:

- It is not a plant, but it needs plants to be produced.
- It is made by an insect.

Do you think you know the answer? To find out if you are correct, and to sample a treat made of this sweetener, please come to the Front Desk at the Haggerty Education Center and tell the Receptionist - I know “How Sweet it Is!”

Additional resources and links can be found at

www.arboretumfriends.org/resources



morrisparks.net



morris county park commission

Atzec Sweet Herb *Lippia dulcis*

Aztec Sweet Herb (*Lippia dulcis*) is a perennial herb native to Mexico, the Caribbean, and Central America.

Here in New Jersey, it can be grown as a sun-loving annual.

Historically *Lippia dulcis* was used by the Aztecs as not only as a sweetener, but also as a tincture of its leaves and stalks in the treatment of bronchitis, indigestion, hypertension, and to induce menstruation, therefore as an abortifacient. Although it is 1500 times as sweet as sugar, its high camphor content makes it unsuitable as a sugar substitute and is considered by some to be toxic for ingestion. It can be tolerated by some people in small quantities only and by others, not at all. Rub the leaf gently and, if it is a warm sunny day, you will discern a slight camphoraceous scent.

Agave Agavaceae

The thick, sweet syrup produced by squeezing the juice from the Agave plant is one of the newest sweeteners in American grocery stores, but it has been used for thousands of years as an ingredient in Mexican food. The nectar, known there as *aguamiel*, or "honey water" was prized by the Aztecs, as was the agave itself, considered a gift from the gods. The liquid from the agave's core has been used to flavor foods and drinks for centuries.

Agaves are large, spikey plants that resemble cactus or yuccas in both form and habitat, but they are actually succulents. Agaves come in many sizes and colors – well over 100 species. The taste of agave nectar is comparable, though not identical, to honey. Agave syrup is 150% sweeter than sugar and is often substituted for sugar or honey in recipes.

Corn *zea mays*

Many of us enjoy corn on the cob, as it is growing here. But the predominant use of corn in modern day agriculture is for the production of a sweetener.

High fructose corn syrup is a low-cost sweetener that has replaced sugar in thousands of products over the past 30 years. In 1970, Americans consumed less than a pound of the syrup per year. In 2010, the average American consumed over 60 pounds per year.

Corn syrup helps baked goods achieve a brown crust and retain moisture. Soft drinks use high amounts of the syrup as a source of intense sweetness and as a preservative. High fructose corn syrup can also be found in most breakfast cereals, fruit drinks,

processed foods and even cough syrup.

Miracle Fruit *Synsepalum dulcificum*

Miracle fruit, is a plant with a berry that, when eaten, causes all foods eaten after that, and especially sour foods (such as lemons and limes) to taste sweet. This effect is due to the compound miraculin. The plant's common names include miracle fruit, miracle berry, miraculous berry, sweet berry, *agbayun*, *taami*, *asaa*, and *ledidi*. Native to West Africa, it is used there to sweeten palm wine and in baking.

Here in New Jersey, it may be grown outdoors in the summer and then as a house plant in the winter. Keep it moist and mist it several times a day as it likes high humidity.

When the fleshy part of the fruit is eaten, a molecule of miraculin binds to the tongue's taste buds, causing sour foods to taste sweet. Miraculin binds and blocks the sour taste receptors and activates the sweet receptors, resulting in the perception of sweet taste. This effect lasts until the miraculin is washed away by saliva, or in about one hour.

Sorghum

Sorghum bicolor, is the cultivated species of sorghum, native to Northern Africa. There it is also known as *durra*, *jowari*, or *milo*. There are several kinds of sorghum, some grown as "corn broom," others used to make ethanol and for animal feed. *Sorghum bicolor* is a grass that grows in clumps reaching over 6' high and is referred to as "sweet sorghum."

The juice from this grass can be processed into a dark, sweet syrup similar in flavor to molasses without the bitterness associated with molasses. It can be used in any recipe calling for molasses.

Sorghum is cultivated in many parts of the world today. In many parts of Asia and Africa, its grain are used to make flat breads that form the staple food of many cultures. The grains can also be popped in a similar fashion to popcorn.

Sugar Maple

These seedlings will grow to be a pancake's best friends. Sugar Maples are known for their brilliant fall colors and sap that is the primary source for maple syrup. Many maples produce a sap that can be tapped and eaten, but *Acer Sacharrum*'s is the sweetest.

Maple trees should be 10-17' in diameter before being tapped. A tree within 18'24 diameter can support two taps. A group of sugar maples trees is called a sugar grove or sugar bush. Sugar maples need their leaves exposed

to sun to make sap. If they are an understory tree, they will not produce enough sap to tap. A cycle of warm and cool periods is essential for sap flow during the tapping season. Too warm or too cool temperatures reduce the amount of sap and thereby the amount of syrup. Tapping does not harm the tree. Only about 10% of the tree's sap is usually tapped and that amount is too small to harm a healthy tree under normal conditions.

Sugar

The plant we are trying to grow here has traveled the world and changed it. Sugar cane was first grown by the people of New Guinea, sometime around 8,000 BC. After domestication, its cultivation spread rapidly to Southeast Asia, southern China, and India, where refining the juice into granulated crystals developed. In 1493, on his second voyage, Christopher Columbus carried cane seedlings to the New World.

Originally, people chewed sugarcane raw to extract its sweetness. Indians discovered how to crystallize sugar, around 350 AD.

Early refining methods involved grinding or pounding the cane in order to extract the juice, and then boiling down the juice or drying it in the sun to yield sugary solids.

From the 1300-1800's the story of sugar cane is told on plantations. It is marked with turmoil and sadness. This is ironic, as so many products using sugar are eaten at celebratory occasions.

Stevia *rebaudiana*

Five years ago, few Americans knew about the stevia plant. Now, one can find a powder made from its leaves and marketed as a sugar substitute easily in any supermarket right next to the sugar.

Stevia rebaudiana is an herb in the *Chrysanthemum* family which grows wild as a small shrub in Paraguay and Brazil.

Paleo-botanists have determined that *Stevia* has been used to sweeten a native beverage called *mate* since Pre-Columbian times. Cultivated mainly in Paraguay, Brazil, Japan, and China, there are other growers scattered across the Pacific Rim. *Stevia* is used in numerous food applications. Primarily it is used as a prepackaged replacement for sugar and artificial sweeteners.

The crude *Stevia* leaves and herbal powder are reported to be 10 to 15 times sweeter than table sugar.

Since *Stevia* is 10 to 15 times sweeter than sugar, that is a good approximate replacement factor.