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Stevia : A Zero Calorie Natural Sweet Fix

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Abstract

Stevia is a sweetner and a sugar substitute. It is a natural substitute and It's made from a leaf related to popular garden flowers like aster and chrysanthemums. Stevia sweetness are extracted and purified from the *stevia rebaudiana* bertoni plant. With continued increasing rate of obesity, diabetes, and other problems, in conjunction with global public policies calling for reductions in sugar intake. This appeal is related to stevia being plant based , zero calorie and with a sweet taste that is 45-350 times sweeter than sugar, making it an excellent choice for use in sugar and calorie reduced food and beverage product. Low and no calorie sweetners such as stevia are gaining interest among consumers and food manufacturers. "In 1991, stevia was banned from U.S. due to early studies that suggested that it may cause cancer." Multiple companies argued with FDA to be categorized as GRAS (generally recognized as safe) so that it could be a sweetener in food and beverages. Stevia seems to be king sweetner not only for diabetics looking for a zero-carb natural sweetner but for a wide array of the population as well.

Introduction

Stevia rebaudiana bertoni is small perennial woody shrub of the Asteraceae (compositae) family that is native to Paraguay, brazil. The leaves of this plant have been used by people for centuries in medicines and to sweeten drinks such as a green herbal tea. The plant was first brought to the attention of the botanist Moises Santiago Bertoni in 1887, who learned of its properties. The chemical characterization of the natural constituents of plants known as steviol glycosides, which are responsible for its distinct sweet taste. *Stevia rebaudiana* is a small perennial growing upto 65-80 cm tall, with sessile, oppositely arranged leaves. Different species of stevia contain potential sweetening compounds, with S. rebaudiana being the sweetest of all. Stevia is a semi-humid subtropical plant that can be grown easily like any other vegetable crop even in the kitchen garden. The soil should be in the PH range 6.5- 7.5; well-drained red soil and sandy loam soil.

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Saline soils should be avoided to cultivate this plant. Stevia has been cultivated successfully in recent years in many areas of Indian states: Rajasthan, Maharashtra, kerela. The increasing demand for natural sweeteners have driven the farmers in india towards large scale production of stevia cultivation.

Composition of stevia

It has been reported that ,"six sweet-tasting compounds are there in the leaves of *Stevia rebaudiana* bertoni- stevioside, rebaudioside A,D, and E, dulcoside Aand B. Stevioside is a glycoside with a glucosyl and sophorosyl residue attached to the aglycon steviol; the latter has a cyclo-pentanoperhydrophenanthrene skeleton. The stevioside is a natural sweetener extracted from leaves of stevia .

The sesquiterpene lactones are responsible for the bitter after taste.a european patent held by the stevia company, which attributes the bitter after taste to the presence of essential oils, tannins, and flovonoids. The poined out thing is, stevioside and rebaudioside A are partially responsible for the after taste. The S.rebaudiana bertoni contains a complex mixture of labdane diterpenes, triterpenes, stigmasterol, tannis, volatile oils, and eight diterpenenic glycosides; stevioside, dulcoside and rebaudioside A,B,C,D, and E. According to Pederson (1987), stevioside is a white, crystalline powder extracted from the leaves of the stevia plant. It must be kept in an air –tight package to prevent moisture absorption. Researchers reported that 3000 g stevia could produce 101.56g light yellow fine powder of stevioside and its products.

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Table I. Proximate composition of *S. rebaudiana* Bertoni.

Sample number	Constituent	Value (%)
1	Aluminium	0.0072
2	Manganese	0.0147
3	Ash	6.3000
4	Phosphorus	0.3180
5	β-Carotene	0.0075
6	Potassium	1.7800
7	Calcium	0.5440
8	Protein	11.200
9	Chromium	0.0039
10	Selenium	0.0025
11	Cobalt	0.0025
12	Silicon	0.0132
13	Fat	1.9000
14	Sodium	0.0892
15	Fibre	15.200
16	Tin	0.0015
17	Iron	0.0039
18	Vitamin	0.0110
19	Magnesium	0.3490
20	Water	82.300

Cultivation

Stevia is a semi-humid subtropical plant that can be easily like any other vegetable crop. Many agrotechnologies are involved in the cultivation and study of various parameters like mean height, weight of leaves, growth per day, total biomass yield and stevioside content in the plant. The crop could be transplanted in February or march and seed collected in the late summer. Flowering under these conditions should occour between 54^{th}-104^{th} day this transplanting depending on the day length sensitivity of cultivars used for seed production. Leaf yield increased with increasing density upto 83,000 and 111,000 plants/ha for the first year of production.

Climate

Nutrition and climate conditions play important roles pn the growth and secondary metabolites of stevia. Some varieties appear to be photoperiod insensitive. Early flowering lines tend to have higher stevioside content but lower total yield.

- Vegetative growth is reduced when temperatures are below 20 deg/C and when day length is less than 12 hours.
- Increasing day length to 16 hours and increasing light intensity can increase vegetative growth and stevioside levels.
- Concentration of stevioside in the leaves increases when the plants are grown under long day conditions where the vegetative period is longer.

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- the natural habitat of stevia is semi humid subtropical climate on the tropic of Capricorn (22-23 deg/S latitude). It is semi humid subtropical plant that shows higher leaf production under high light intensity and warm temperature.

Soil

The nutritional dosage is strongly governed by the soil properties and climate conditions of the growing region.

- Stevia grows in well drained fertile sandy loam or loamy soil, richin organic matter.
- It prefers acidic to neutral (ph 6-7) soil for better growth and require consistent soil moisture but not water logged field.
- Urea fertilizer should be applied in three split doses as once at basal and remaining two after the first and second cutting of leaves.
- Sometimes stevia shows the symptoms of boron deficiency, which leads to leaf spot that can be rectified by spraying borax 6%.

Propagation

- Vegetative propagation is the best way for seed multiplication of stevia due to low seed germination capacity.
- In vitro propagation can become an important alternative to conventional propagation and breeding procedures for a wide range of plant species.
- Stevia is grown in the same field after uprooting the mother plant.

Various types of propagations are:

a) Vegetative propagation- shoot cutting

b) Micro-propagation

c) Seed propagation

Vegetative propagation Shoot cutting

propagation of stevia is usually done by stem cutting, which root easily but require high labour inputs. Some plants varities/selections produce virtually no viable seed and vegetative propagation is the only way of multiplication. In this a vigorous branch is cut at the base with a sharp blade and planting in the field, keeping two to three nodes above the soil. The cut portion of branch is dipped in neem oil or any fungicide (Maiti and Purohit 2008). Cuttings of new stems and shoots can be propagated successfully.

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Micro-popagation

Many different parts of the plant viz, leaves, auxiliary shoots, roots-neck sprouts, shoot primordial, internodal explants etc. can be used successfully for tissue culture propagation . in vitro multiplication has frequently been used to multiply individually selected or bred clones and successful procedures have been documented. Explants from leaf, nodal and inter-nodal segments were cultured on MS medium containing 2,4-D at 2.0, 3.0, 4.0, mg L^{-1} for callus induction and the greatest amount of callus was produced in MS medium with 3.0 mgL^{-1}. The plant growth and stevioside content in the leaves of the plants grown from stem cuttings were more uniform than the plant grown from seeds. The number of roots, shoots biomass and stevioside content were greater in the vegetatively grown plants.

Seed propagation

Reproduction in the wild mainly by seed, but germination and establishment from seen are often poor and sometimes unsuccessful. Seed germination with 7-10 d after sowing propagation through seeds is not a common method of propagation owing to the problem low seed production and poor germination capacity. Using seed to establish crops of stevia is more successful in tropical climates, where there is no climate restriction on the length of growing season. Seed production and fertility studies suggest that high germination rates are possible from selected lines timing of flowering, seed harvest and pollination methods play important role in seed production. Direct seedling to the field is not practiced but may be a requirement for large scale commercial production.

Irrigation

- **Stevia** cannot grow in dry conditions.
- Sprinkler irrigation is found to be advantageous since the herb is highly sensitive to water stress.
- Requires frequent light irrigation.
- During summers, watering at an interval of 3-5 days gives best results.
- To reduces the impact of high temperature and drought addition of mulches around the plant is recommended.

Harvesting

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Harvesting of stevia depends on land type, variety, and growing season. Following are the major points for harvesting:

- 1st harvest of crop can be done four months after planning and after every 3 months.
- Best harvest time is mid-september to late September when plants are 50-70 cm in height. As short days induce harvesting.
- The easiest harvesting technique is by cutting the branches off with pruning shears.
- On average, three commercial harvests can be obtained in year. It is better to cut the plant leaving about 10cm stem portionfrom the ground.
- For domestic use, leaves may be used fresh for tea or may be combined with mint leaves.

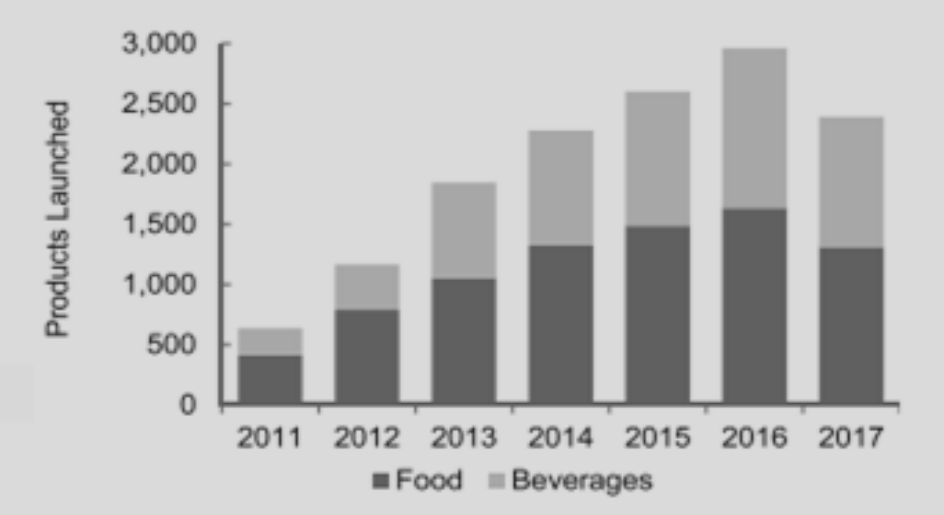

Fig. number of stevia food and beverages

Medicinal properties

- Stevia is a sugar substitute. Using stevia instead of sugar is an excellent way to improve your health. Make teas from it or dry the leaves and make stevia powder to add to your dishes, sooft drinks etc.
- Stevia has a stronger flavor, its taste and texture is more durable than sugar, as it is composed of glucose and rebaudioside, elements that naturally make it sweet. Stevia extract contains upto 300 times the sweetness of sugar.
- Stevia plant have very low calorie, which makes it perfect for people who are on diet.it is not digested by our digestive system means that we don't absorb the calories that it contains.

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- It is ideal for losing weight, being sweet but low in calorie.
- Helps to reduce anxiety levels, cravings or the need to constanly eat sweet things.
- It doesn't affect blood sugar level, its properties means that eating this plant improves glucose tolerance, which makes it a wonderful sugar substitute for diabetics.
- Besides being the perfect sugar substitute, stevia is characterised by having other beneficial effects for both fat absorption and blood pressure.
- Stevia has antibiotic properties making it effective againt bacteria or fungi.
- Growing stevia at home can be great help in your everyday life. This plant relieves fatigue, aids digestion, and can be used as treatment for blotchy skin and spots.
- In Japan, artificial sweeteners were banned some 40 years ago. So, stevia has been their chosen alternative to sweeten their food and beverages. Japanese have performed over 40,000 clinical studies and found stevia to be the safe.

Uses of stevia

- Stevia is safe for diabetes, as it does not affect blood sugar levels.
- Mild stevia leaf tea offers excellent relief for an upset stomach.
- Stevia doesn't have neurological pr renal side effects as other artificial sweeteners.
- Stevia possess antifungal and anti-bacterial properties in addition to its other versatile uses.
- It can be safely used in herbal medicines, tonics for diabetic patients.
- It is also added in daily usage products such as mouthwashes and toothpastes

Conclusion

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It can be concluded that very exhaustive work has been done on the plant and it is found that stevia is such an natural sweetener with many medicinal properties and also have zero calorie property. Stevia is a plant helps to maintain our healthy lives. Several global and country level authoritative dietary guidelines recommend a reduction in added sugar intake due to the growing prevalence of overweight, obesity, and diabetes around the world and these guidelines include recommendations to keep added sugar intake 10%of total calorie intake. The replacement of calorie sweeteners in food with high purity stevia leaf extract sweeteners is a useful and cost effective tool in reducing added sugar intake. *Stevia rebaudiana* is gaining popularity in various developed and developing countries as an important crop for the production of non nutritive, non toxic, high-potency sweeteners. In the recent past, research has been conducted around the world on various aspects of crop improvement, the development of new varieties, propagation, seed production, cultivation. And cultivation of stevia should be increased compared to previous years.

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