**STEVIA - THE CALORIE FREE NATURAL SWEETENER**

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**Introduction**

Stevia, botanically known as *Stevia rebaudiana Bertoni* (Family: Asteraceae) is a sweet herb, which is a native of Paraguay and widely distributed in USA, Brazil, Japan, Korea, Taiwan and South East Asia. The plant is a slender perennial herb growing up to a height of 60-70 cm with sessile, oppositely arranged lanceolate to oblanceolate leaves, serrated above the middle. The flowers are small, white and arranged in an irregular cyme.

This Sweet Honey Leaf herb is likely to become the major source of high potency sweetener for the growing natural food market, in the years to come. Stevia finds its use as a natural sweetener, replacing the chemical sweeteners and even table sugar. The sweetness in the leaf is due to the presence of an intensive sweetening agent called stevioside (6-12% on dry weight basis). Experiments have proved that stevioside is 300 times sweeter than sucrose apart from being a calorie free sugar. Hence Stevia has been named as "CALORIE FREE BIO-SWEETENER OF HIGH QUALITY".

Stevia is a new promising renewable raw stuff for the food market. The market potential for this natural sweetener is still untapped. It is estimated that about 21 million Indians are presently suffering from diabetes and it is proposed that by 2010 India's contribution to the diabetic global population would be a whopping 60 million. With such a huge share of the population being diabetic, the new ventures in the food industry are focussed entirely on them.

The soft drink manufacturers in India are yet to exploit the sweetness of this herb by its addition in their product. Though many soft drinks are introduced in the market with the prefix 'dia' connoting that it is meant for the diabetics, the usage of Stevia in such products would fetch a greater demand than for the one with artificial sweeteners.

The beverage industries like tea and coffee manufactures have just started introducing new products for the diabetics, realizing the major share held by them in the consumer market. As tea and coffee has been the non-replaceable best beverage for every Indian, this sector has enormous potential to come up when the natural sweetener, Stevia is used in their products.

All those 'dia' prefixed products in the market at present are sweetened with artificial sweeteners that is, of course, equally sweet, but with undetectable side effects in due course. Stevia a natural sweetener, fully plant-based may replace the artificial sweeteners completely. As Stevia leaf powder with no processing is highly safe to use, calorie free and moreover around 20-30 times sweeter than cane sugar, it can replace cane sugar too. Stevia leaf powder is so simple in making when compared to the cane sugar that involves very tedious steps to process.

**Uses of Stevia leaves**

The present scenario is that people are more inclined towards products advertised with a brand name 'All natural and Low CHO'. Hence the food industry would grab a major share in the market if Stevia, the natural sweetener is used as sweetening agent in the products like biscuits, jams, chocolates, ice-creams, baked foods, soft drinks, soda, candies and the common beverages like dip tea, coffee and herbal tea that are focussed, in particular for the diabetics and the health conscious consumers.
Application in bakery, confectionery, soft drink and beverage sector

The bakery industry holds a stand to bring an impact by the usage of Stevia. All cooked and baked food items like puddings, desserts can be sweetened with only very small quantities of Stevia leaf powder as compared to table sugar. 50 g of Stevia leaf can replace 1000 g of cane sugar. As the sweetness of stevioside is non-fermenting and the non-browning when cooked, further widens its area of application in baking enhancing the quality and safety of usage with a longer shelf-life period. Breads made with Stevia as an ingredient for diabetic customers has proved to show improvement in the texture and softness of the bread and increased shelf-life.

The confectionery industry is yet to reap the benefit of Stevia, which can replace the usage of sugar as a sweetener, at a relatively comparable cost of Rs.300 per kg of dried leaves of Stevia. The leaves can be used in chocolates and candies not only to meet the market demand by the diabetics, but also to harvest the added advantage of this herb that it does not encourage tooth decay. Stevia possessing an anti-microbial property can be used in all the sweets, which is of great fond to the children, as it does not enhance the growth of any bacteria in the teeth, unlike the sugar.

A mere fragment of the leaf is enough to sweeten the mouth for an hour. So Stevia leaves afresh is more than a chewing gum, though Stevia can be used in the making of chewing gums, mints and mouth refreshers.

The soft drink manufacturers have introduced several health drinks and many food supplementary beverages, especially for the diabetics. Majority of the food supplementary products for the diabetics emphasizes on the fibre and protein content, etc. The addition of Stevia leaves (dried) as such or powder, in such products would not only aid in increasing the sweetness naturally but also helps in rejuvenating the pancreatic gland. Apart from this, Stevia is nutrient rich, containing substantial amount of protein, calcium and phosphorus.

The Beverage industry has a widely open scope in blending Stevia leaves with tea and coffee. Blending ensures value addition to the product, simultaneously, easing the preparation of the drink. Stevia leaves can be made available in tea bags to make tea more delicious for the diabetics. Tea bags may be placed in any beverage desired and delightful lemonade can be prepared.

Stevia consists of 6-12% of stevioside which can be extracted as a liquid concentrate that can be used directly in the soft drinks, beverages, chocolates, etc.

Household usage

The leaves of Stevia impart a pleasant flavour apart from increasing the sweetness to the product. The Stevia leaves or their powder can be used without much process in most of the typical Indian dishes like chakkara pongal, payasam, ravaa ladoo, sauces, jams, juices, pickles, tea, coffee, and even herbal tea. Most of these products are available as ready-made mixtures in neatly sealed packs. Stevia, with them would implant additional acceptable flavour in the mixtures, besides easing the work.

Fresh juice making is another such area that is still unexplored. The fresh fruit juice can be made cent per cent fresh and natural by the addition of this natural sweetener, Stevia, instead of cane sugar. The sweet deprived diabetics can relish their favorite sweets with Stevia without any compromise for the sweetness, in addition to the health restoring activity of this herb.

Ground Stevia is excellent when sprinkled lightly over cooking vegetable and meat, cereals and salads. Besides adding its own sweet taste, it significantly enhances the flavour and nutritional value of the food.

Medicinal property

Stevia is such a versatile herb with incredible sweetness that possess anti-fungal and anti-bacterial property also. It can be safely used in herbal medicines, tonics, for diabetics and also in the daily usage products like mouth washes, and tooth pastes.

Mild Stevia leaf tea offers excellent relief for an upset stomach. A wet Stevia leaf bag may be placed over the eyes for cooling (similar to using cucumber). The leaves effectively tightens the skin and are good for wrinkles. Stevia has proved to give exceptional benefits when used regularly in skin care. It also has a healing effect on the blemishes, wounds, cuts and scratches.

Stevia is also helpful in weight and blood pressure management. It has also been reported that Stevia lowers incidence of colds and flu.
Cultivation

Stevia is a semi-humid subtropical plant and can be grown easily as any other vegetable either few in the house or a few hundreds in the garden. The plant reaches a height of 45 cm in three months. This is a short day plant. The concentration of stevioside in the leaves of Stevia increases when the plants are grown under long day condition. While cultivating Stevia on a large scale, this can be grown in well-drained red soil and sandy loam soil. The soil should be of fine tilth with a pH range of 6.5-7.5. The saline soils should be avoided to cultivate this plant.

Since the seed germination is very poor, it is propagated vegetatively. Though stem cuttings are used for vegetative propagation, tissue culture plants have proven to be the best planting material for stevia. The tissue culture plants of stevia are not only genetically pure, plants are free from all pathogens and with excellent vigour. The tissue culture plants can be planted throughout the year except during peak summer. An ideal planting density is 75,000 plants per hectare with spacing of 23 x 40 cm in raised bed system. The soil can be enriched with a basal dressing of 63 MT of well rotten farmyard manure/hectare.

As the plant cannot tolerate drought, frequent irrigation is required. It is recommended to have micro-sprinklers for better results. Irrigation is scheduled depending on the moisture holding capacity of the soil, light intensity and the wind velocity. Stevia can grow in places where the climatic conditions are favourable and the maximum day temperature not exceeding 38°C and the night temperature not falling below 10°C. First harvest can be made after four to five months from the time of planting. Subsequent harvests can be made every three months, for three consecutive years. The sweetener in the leaf is maximum till the plant flowers. Just before flowering, the plant should be cut leaving 10 cm from the ground, from where again new flush of leaves will sprout, which will be ready for harvest again in three months time. The plant yields around 7500 kg of dried leaves from an hectare plantation every year. To facilitate more of vegetative growth the flowers should be removed.

Growmore Biotech Ltd, situated at Hosur is a tissue culture laboratory, working on several plants like banana, sugarcane, paulownia, casuarina and several medicinal plants and ornamentals. Growmore has been doing research on Stevia for the past two years. Having imported the plants, Growmore has standardized the tissue culture technology and the cultivation practices for this plant in its biotech laboratory and farm. Stevia, which is not available in India has been multiplied in large numbers and introduced among the growers. The company is supplying a few lakh plants every month to the farmers and a few thousands to the home medicinal gardens.

With extensive studies conducted at Growmore Biotech Laboratory and the fields, it is found to be highly suitable plant for India, especially for sub-tropical climatic conditions. Though the investment on the cost of cultivation is around Rs. 8.8 lakhs per hectare in the first year, the returns are attractive. It gives immense scope for intensive agriculture and precision farming for those who are interested in high return agriculture.

Conclusion

Stevia is a potential alternative source for replacing artificial sweeteners like saccharin, aspartame, asulfam, etc. unlike many low calorie sweeteners, stevioside is stable at high temperature and over a range of pH 3-9. Steps need to be properly aligned to exploit the natural sweetness of Stevia. Food industrialists may start launching new products with the blend of Stevia, which would obviously provoke the need to grow more and finally resulting in more area under Stevia cultivation. Programmes need to be organized to promote this natural sweetener and create product awareness. This would be the right approach to unlock the sweetness of this herb, in to our day - to - day life.

References

1. Starratt A N and M Gijzen, Agriculture and Agri-Food Canada, Southern Crop Protection and Food Research Center, 1391 Sandford St., London, Ontario N5 V 4T3.
3. mcolombus@omafra.gov.on.ca
4. Stevia.net
COST OF CULTIVATION OF STEVIA IN ONE HECTARE

LAYOUT: BED SYSTEM  SPACING: 23 × 40 CM  NO. OF PLANTS/HECTARE: 75,000

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Mode of Operation</th>
<th>I year (Rs.)</th>
<th>II year (Rs.)</th>
<th>III year (Rs.)</th>
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<tr>
<td>1</td>
<td>Cost of planting material 75000 × Rs.8.00/poly bag plant (size 10 × 8 cm)</td>
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<td>2</td>
<td>Actual transportation cost 10,000 plants/load @ 2,000 per load, 8 × 2000</td>
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<td>3</td>
<td>Preparation of land 4 ploughing × Rs.625</td>
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<td>4</td>
<td>Preparation of beds 25 × Rs.75</td>
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<td>5</td>
<td>FYM application and cost 65 MT @ Rs.750/MT = Rs.48,750/- + 2500</td>
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<td>6</td>
<td>Planting of Stevia plants 50 × Rs.40</td>
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<td>7</td>
<td>Gap filling, plant cost and planting</td>
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<td>8</td>
<td>Irrigation 125 × Rs.75/-</td>
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<td>9</td>
<td>Micro sprinkler for 1 ha</td>
<td>75,000</td>
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<td>10</td>
<td>Fertilizer and application cost 275:115:115 NPK/AC Rs.10000+1500</td>
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<td>11</td>
<td>Plant protection and application 2500 + 500</td>
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<td>12</td>
<td>Harvesting 300 × 40</td>
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<td>Drying arrangements and fans</td>
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<td>Drying and post harvest 300 × 40</td>
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<td>15</td>
<td>Hand weeding 10 times 10 × 25 × 40</td>
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<td>Supervisory charges 12 months × 3,000</td>
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Total Expenditure

872,500 182,625 182,625

Contingency cost

2,000 5,000 5,000

Total expenditure

874,500 187,625 187,625

INCOME:

I YEAR 6750 kg. dried leaf/ha × Rs.200

II YEAR 6750 kg. dried leaf/ha × Rs.200

III YEAR 6750 kg. dried leaf/ha × Rs.200

NET PROFIT

475,500 1,162,375 1,162,375

Net profit for 3 years

2,800,250

Note: The above calculations are made only for 3 years. In good condition the plants can be grown economically for 5 to 7 years.