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STEVIA REDAUDIANA IN THE INDIAN HORTICULTURE

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The Stevia Redaudiana is the natural sweetener commonly known as sweet leaf or sugar leaf belongs to family Asteraceae (Genus Jan, 2003). It is an herb whose plant size is 60-120cm, whereas that of leaves is 3-4 cm. It is a rich source of sweetener and the best substituent of sugar. The leaves are hairy on the upper surface while it is woody on the lower surface. The herb after the hoar grows in spring. The flowers are whitish and come in the month of July to September. There are 240 known species of Stevia. Of these, 18 species were found to be used after further processing for the sweetening (Soejarto *et al.* 1982). The leaves are 30 times and its entrants are 300-400 times sweeter than sugar and are long-lasting. It is rain resistant horticultural crop plant that can be grown in the rainfed, water lodging or even in less fertile soil. It can be only damaged by over or heavy rain. Winter is the best growing season but in the northern states of India due to longer exposure to summer and hot wind, the concentration of sugar increases optimum temperature 10-30 degrees centigrade with 65-85% humidity and 5.5 to 7.5 pH soil.

The whole chemical composition of this Plant is not known but some emeritus had revealed certain chemically active glycoside and its derivatives such as glucoside-A, rebaudioside A-E but the economic value is returned by the enrichment as well as stabilization of the two main compounds i.e., stevioside (10-20%) in the Stevia leaves which is stable at 100-degree centigrade whereas Rebaudioside-A (1-37%) which is stable at 120-degree centigrade. Due to its stability at a higher temperature, Stevia is a thermally stable compound. Chemical composition which is known mostly belongs to diterpene which is immobilized or inter-converted into the different chemical compound, zero-calorie and hygroscopic in its natural condition (Kinghorn *et al*. 1984, Shibata *et al.* 1995, Ngowatana 1997, Kumar *et al*. 2007, Soejarto *et al*. 1982). The solution of stevia has been found to be neutral (i.e., stevia + distilled water in various proportions) therefore, it maintains the

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chemical and ionic equilibrium of the corresponding medium. The plant of Stevia has a saturated amount of meditational values as it is used for the curing of heart disease, dysentery, asthma, high blood pressure, etc. Besides this, it also acts as an antibacterial for the mouth and pampers on the face. It is also used in the preparation of different daily needs such as chewing gum, mouth wash, toothpaste, and many other herbal tea powders. It also improves insulin sensitivity and can be used for a dietary supplement. Along with these it can be utilized as food products such as sauce, pickles, ice-creams, ice-cakes and also in pharmacculated formulae due to processing non-farming properly.

Apart from this, Stevia is rich in protein, various nutrients like magnesium, niacin, riboflavin, zinc, chromium, selenium, calcium and phosphorous. Stevia dried leaves when are used in powdered form, it not only helps in increasing the natural sweetness but also help in regenerating the pancreatic glands. It can acts as a ray in the dark for diabetic patients. The dried leaves are considerately sweeter than fresh leaves and can also be used as an aid in the tea powder. Stevia extract is so extensively sweet that a pinch is generally recommended to use and the remaining is being refrigerated.

(Source Figure: reports of agri-farming, 2018)

The chemical compounds which are fairly present in adequate amount are generally hygroscopic in nature (Ngowatana, 1997). Pederson, 1987 reported the chemical composition and comparative study between sugar leaf and extract of the Stevia which is tabulated as follows:

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Table 1: Elemental composition of Stevia

Sample number	Elements	Constituent Value (%)
1	Al	0.0072
2	Mn	0.0147
3	Ash	6.3
4	P	0.318
5	b-carotene	0.0075
6	K	1.78
7	Ca	0.544
8	Protein	11.2
9	Cr	0.0039
10	Se	0.0025
11	Co	0.0025
12	Si	0.0132
13	Fat	1.9
14	Na	0.0892
15	Fiber	15.2
16	Tin	0.0015
17	Fe	0.0039
18	Vitamin	0.011
19	Mg	0.349
20	Water	82.3

Table 2: Comparative Study

Granulated sugar	Stevia leaf powder	Stevia white extract
1 Teaspoon	1/8 teaspoon	Dust
1 TableSpoon	3/8 teaspoon	1/2 Pinch
1/4 cup	1/2 teaspoon	1/8 Pinch
1/2 Cup	1 Table Spoon	1/8 teaspoon
1 Cup	2 Table Spoon	1/4 teaspoon

Source: Pederson, 1987, Approximate composition of Stevia rebaudiana Bertoni Nutr Herbol 18:377–380.

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The scenario of Stevia cultivation

In the day to day life, people use low-calorie food results in the overutilization of calories and thus cause hazards to the health and gradually create serious health problems like diabetes, heart disease, dysentery, asthma, high blood pressure, etc. The artificial marketed products are used to reduce the calories of the day which would cause long term side effects creating different problems. Stevia leaves widely grown for its sweetening products, soft drinks, and candies especially in Japan (Soejarto *et al.* 1982).

Stevia is the native plant of tropical and subtropical regions of North and South America. Nowadays, it is grown and distributed in various different parts of a country widely such as Brazil, Columbia, Venezuela, etc. for natural therapy (Jeppesen *et al.* 2000, Suttajit *et al.* 1993). In countries like Venezuela, it is used for the last 1500 years. A good marketed price with good Stevia cultivation is developed domestically as well as internationally. Stevia in India is cultivated in a different part of the country such as Gujarat, Maharashtra, Rajasthan, Punjab, etc. Its distinctive flavor blends with aromatic species such as Cannon & Ginger. All new and latest techniques of farming are used in its cultivation.

Management practices in the cultivation of Stevia

Stevia is propagated by stem cutting and by seeds. The seed rate of stevia is generally recommended at 400-450gm/ha. Due to herbaceous nature, it has a tendency to germinate 100%. Propagation with seeds is cost less but time-consuming process while that of stem cutting cost-effective but grows very severely. Therefore, the development of a new and better variety of stem cutting by biotechnical process increases at an accelerating rate.

Plowing preparatory tillage is required before sowing. The manure and fertilizers are sprinkled, mixed with the soil before the formation of the rows. It lives well in nitrogen-deficient soils. Plants are prepared 10-12 days before sowing into different rows into the field. Its sowing should be followed in the month of March- April for summer months while June-July in winter months. The seeds are to be sown at a distance of 45cm*45cm in summer and 45cm*30cm in the winter. As a vegetable, Stevia also requires organic manure to be enriched. During the cultivation of Stevia, the use of insecticide and pesticide is strictly prohibited. It cannot survive in the drought and frost condition hence, irrigation is done just after sowing and second irrigation are done 2-3 days after sowing however irrigation is not

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required in the rainy season. The crop should be kept always free from the weed therefore proper training and pruning is required. In general practice, 4-5 training is required during its early stages to keep away from the weeds. Mulching practice gives the best result. Mulching with the rice husk seems to give the best result than any other mulching material. The plants are practiced in two ways i.e. sympodial and monopodial ways. In the sympodial approach, the buds are broken just 20-25 days after planting to increase the number of branches while for the quality we use monopodial type cultivation.

The plants should be cut 10-15 cm above the ground so that it should be followed with the difference of 3 months of sowing. The second harvesting should be done in between 60-70 days from the first cutting. If the practice is delayed then it should be delayed for harvesting for 3-4 months. It is the perennial type crop which gives the cultivation for 4-5 years. 3-4 times of plant cutting is required in a year. Maximum leaves are obtained in the 3rd and 4th year of sowing. The yield coming out from the practice is 20-30 tones. This gives 4-5 tones of dry matter. Total dry leaves obtained first, the second, third and fourth year is 17, 20, 23, 25 tons per hectare.

Statistically, the production of Stevia is low corresponding to the present demanding scenario. Thus, various government societies and non-government organizations such as the Indian Institute of Vegetable Science (Varanasi), Hahnemann Charitable Mission Society (HCMS, Jaipur) organizes training programs to enhance the production of Stevia Cultivation. The attendee could be individuals, Co-operates, entrepreneurs and rural farmers whoever wants to cultivate.

Conclusion

Stevia is a natural origin, zero-calorie, sustainable sweeter. The safety of high purity stevia extract for human consumption has been established through rigorous peer-reviewed research. All major global regulatory organizations, including the Food and Agriculture Organization/World Health organization's Joint Expert Committee on Food Additive (JECFA), the European Food Safety Authority (EFSA), the Food and Drug Administration (FDA), and Food Standards Australia New Zealand (FSANZ), have determined high purity Stevia extract to be safe for use by the whole family.

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