
Commercial Cultivation of Stevia (*Stevia rebaudiana* Bertoni) in the Shevaroy Hills

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ABSTRACT

Stevia rebaudiana (Bertoni) is a perennial medicinal herb belonging to the family Asteraceae and is widely recognized as a natural, non-caloric sweetener due to the presence of steviol glycosides, particularly stevioside and rebaudioside A. These compounds are approximately 200–300 times sweeter than sucrose and have gained considerable importance in the food, beverage, pharmaceutical, nutraceutical, and cosmetic industries. The increasing prevalence of diabetes, obesity, and other lifestyle-related disorders has significantly enhanced the global demand for stevia as a healthier alternative to conventional sugar. However, large-scale commercial cultivation is limited by poor seed viability, low germination rates, and the heterozygous nature of the species, making vegetative propagation and tissue culture essential for the rapid multiplication of elite planting material. Stevia thrives under well-drained fertile soils, moderate fertilizer application, optimum temperature, and appropriate irrigation management, which collectively contribute to improved leaf yield and quality. Beyond its sweetening properties, stevia possesses antioxidant, anti-inflammatory, antihyperglycemic, and antihypertensive activities, further expanding its commercial and medicinal value. The agro-climatic conditions prevailing in the Shevaroy Hills, including moderate temperature, fertile well-drained soils, and adequate moisture availability, are highly suitable for the successful cultivation of *Stevia rebaudiana*. This review highlights the botanical characteristics, cultivation practices, propagation methods, and diverse applications of *Stevia rebaudiana*, emphasizing its potential as a sustainable, high-value

crop for supporting human health, agricultural diversification, and the growing natural sweetener industry.

INTRODUCTION

Stevia rebaudiana (Bertoni) is a perennial herbaceous plant belonging to the genus *Stevia* (family Asteraceae), which comprises nearly 230 species of herbaceous plants, shrubs, and sub-shrubs. The leaves of *S. rebaudiana* are rich in steviol glycosides, primarily stevioside and rebaudioside A, which are natural, non-caloric, and non-toxic sweetening compounds. These glycosides possess a sweetness approximately 200–300 times greater than that of sucrose, making stevia an attractive natural alternative to conventional sugar and synthetic sweeteners. Owing to its exceptional sweetening capacity and negligible caloric value, stevia has gained widespread acceptance in the food, beverage, pharmaceutical, and nutraceutical industries.

Commercial cultivation of *Stevia rebaudiana* has expanded across several countries, including China, Japan, Brazil, Canada, the United States, the United Kingdom, Spain, Belgium, Australia, South Korea, Thailand, Israel, and Taiwan. The growing incidence of diabetes, obesity, and other lifestyle-related disorders has substantially increased consumer preference for natural low-calorie sweeteners, thereby driving the global demand for stevia-based products. However, the rapid increase in demand has created challenges in maintaining an adequate supply of high-quality planting material, highlighting the need for improved propagation techniques that can enhance productivity and reduce production costs.

Despite its commercial importance, large-scale cultivation of stevia is constrained by poor seed viability, low germination percentages, and slow vegetative propagation through stem cuttings. These biological limitations hinder the rapid multiplication of elite planting material and restrict the expansion of commercial cultivation. Consequently, conventional propagation methods alone are insufficient to meet the increasing global demand for stevia, emphasizing the necessity for efficient and reliable alternative propagation approaches. Plant tissue culture, particularly micropropagation, has emerged as a promising strategy for overcoming these propagation constraints. This technique enables the rapid production of genetically uniform, disease-free planting material under sterile and controlled environmental conditions using explants such as shoot tips, nodal segments, meristems, somatic embryos, or embryogenic callus. Numerous studies have demonstrated the successful application of *in vitro* culture techniques for *Stevia rebaudiana*, with optimized culture media and plant growth regulator combinations significantly improving shoot multiplication and regeneration efficiency. Therefore, the optimization of tissue culture protocols provides a practical and sustainable solution for the large-scale production of superior-quality stevia planting material, ensuring a continuous supply to support its expanding commercial cultivation and industrial utilization.

TAXONOMY AND BOTANICAL DESCRIPTION

TAXONOMY

- Kingdom: Plantae
- Subkingdom: Tracheobionta
- Division: Magnoliophyta
- Class: Magnoliopsida
- Order: Asterales

- Family: Asteraceae
- Genus: *Stevia*
- Species: *Stevia rebaudiana* (Bertoni)

BOTANICAL DESCRIPTION

Stevia rebaudiana (Bertoni) is a perennial subtropical herb belonging to the family Asteraceae. The plant possesses semi-woody, branched stems that are slightly pubescent and is characterized by a well-developed fibrous root system, which facilitates efficient absorption of water and nutrients. Under suitable cultivation conditions, the plant exhibits a compact, bushy growth habit and generally reaches a height of 60–70 cm.

The leaves are simple, sessile, and arranged in opposite pairs along the stem. They are lanceolate to oblanceolate in shape, with blunt apices and serrated margins extending from the middle towards the tip. The upper surface of the leaf is slightly glandular, containing specialized tissues responsible for the synthesis and accumulation of steviol glycosides, the compounds responsible for the plant's intense sweetness.

Stevia rebaudiana produces small, white, bisexual flowers measuring approximately 10–15 mm in diameter. The flowers are pentamerous, possessing five petals, and are typically arranged in terminal clusters. Although flowering results in seed production, the seeds exhibit poor viability and low germination percentages, making sexual propagation unreliable for commercial cultivation. Consequently, vegetative propagation and *in vitro* micropropagation techniques are widely adopted to ensure the production of genetically uniform, high-quality planting material for large-scale cultivation.

CULTIVATION OF *Stevia rebaudiana*

COMMERCIAL IMPORTANCE AND PROPAGATION

Stevia rebaudiana was first cultivated commercially in Paraguay in 1964 and has since been introduced to many countries due to its increasing demand as a natural, non-caloric sweetener. Although the crop adapts well to diverse agro-climatic conditions, commercial cultivation through seeds is limited because of poor seed viability, low germination percentage, and the short storage life of seeds. Furthermore, the species is highly heterozygous, resulting in considerable genetic variation among seed-derived plants. Therefore, repeated selection of elite mother plants is essential to maintain desirable traits.

VEGETATIVE PROPAGATION

Vegetative propagation through stem cuttings is the preferred method for commercial cultivation because it ensures true-to-type plants with uniform growth and higher sweet glycoside content. Healthy and vigorous mother plants possessing high rebaudioside A content and reduced flowering tendency are selected. Stem cuttings of 8–10 cm length containing one or two axillary buds are commonly used, and treatment with rooting hormones, particularly synthetic auxins, significantly enhances root initiation and successful establishment.

SOIL AND CLIMATIC REQUIREMENTS

Stevia performs best in fertile, well-drained sandy loam or loam soils rich in organic matter with a slightly acidic to neutral soil pH of 6.0–7.0. The crop requires regular irrigation to maintain

optimum soil moisture, but prolonged waterlogging must be avoided as it promotes stem rot and other soil-borne diseases. Partial shade during periods of intense summer heat is beneficial, while photoperiod strongly influences plant growth. Long-day conditions favour vegetative growth and leaf production, whereas short-day conditions induce flowering. The agro-climatic conditions of the Shevaroy Hills (Yercaud), characterized by a moderate climate, annual temperatures ranging from 15–30°C, well-distributed rainfall, fertile well-drained soils, and high relative humidity, provide a favourable environment for the successful cultivation and sustained leaf production of *Stevia rebaudiana*.

TEMPERATURE REQUIREMENTS

An optimum temperature range of 24–35°C is ideal for the successful establishment of stem cuttings during the early growth stage. After transplanting, temperatures between 20 and 35°C promote vigorous vegetative growth and shoot proliferation. However, high temperatures combined with moisture stress may induce premature flowering, leading to reduced leaf yield and quality. Since the leaves constitute the primary economic product of the crop, maintaining favourable environmental conditions throughout the growing period is essential for achieving maximum productivity. The moderate temperatures prevailing in the Shevaroy Hills, particularly during the growing season, are conducive to vegetative growth and leaf biomass accumulation, making the region well suited for commercial stevia cultivation with improved yield and quality.

FERTILIZER MANAGEMENT

Stevia has a moderate nutrient requirement and responds well to balanced fertilizer application. Lower nitrogen levels combined with relatively higher phosphorus and potassium are generally recommended to enhance vegetative growth and leaf biomass. Under normal field conditions, the application of approximately 70 kg nitrogen, 35 kg phosphorus, and 45 kg potassium per hectare has been found suitable for optimum crop performance.

PLANTING DENSITY AND FIELD PREPARATION

A plant spacing of 20–25 cm is commonly adopted, accommodating approximately 70,000–75,000 plants per hectare. Research has demonstrated that increasing planting density up to an optimum level can significantly improve leaf yield. Before planting, the field should be thoroughly prepared by ploughing and harrowing to achieve a fine tilth. Raised beds are recommended to ensure efficient drainage, facilitate irrigation, promote healthy root development, and minimize the risk of waterlogging.

APPLICATIONS OF STEVIA

FOOD AND BEVERAGE INDUSTRY

Stevia is widely used as a natural, zero-calorie sweetener in the food and beverage industry. Its leaves contain steviol glycosides, which are 200–300 times sweeter than ordinary sugar. It is commonly added to bakery products such as cakes, biscuits, cookies, pastries, and muffins, as well as confectionery items like chocolates, candies, chewing gum, and sugar-free sweets. Stevia is also used in dairy products including yogurt, ice cream, flavored milk, and puddings, and in beverages such as fruit juices, soft drinks, herbal teas, and energy drinks. The use of stevia helps reduce sugar and calorie content without compromising sweetness, making it an ideal ingredient for health-conscious consumers.

PHARMACEUTICAL APPLICATIONS

Stevia is increasingly used in pharmaceutical and nutraceutical products as a natural sweetening agent. It enhances the taste of sugar-free syrups, herbal medicines, chewable tablets, lozenges, and dietary supplements. In addition to its sweetening property, stevia possesses antioxidant, anti-inflammatory, antihyperglycemic, and antihypertensive activities, making it a valuable ingredient in health-related formulations.

HEALTH BENEFITS

Stevia is considered a healthy alternative to refined sugar because it contains no calories and has little effect on blood glucose levels. It is highly suitable for people with diabetes, obesity, and metabolic disorders. Regular use of stevia in place of sugar may help in weight management and support healthy blood sugar control. Its natural antioxidant compounds also contribute to overall health and wellness.

COSMETIC AND PERSONAL CARE PRODUCTS

Stevia extracts are incorporated into several personal care products, including toothpaste, mouthwash, lip balms, and herbal skin-care formulations. Its antioxidant and antimicrobial properties help maintain oral hygiene and protect the skin from harmful microorganisms, increasing its value in the cosmetic industry.

AGRICULTURAL AND COMMERCIAL IMPORTANCE

The increasing demand for natural sweeteners has made stevia a high-value commercial crop. It provides farmers with an alternative source of income due to its growing market demand in the food, pharmaceutical, and nutraceutical industries. The cultivation of stevia also supports the development of value-added products and creates new opportunities for agricultural entrepreneurship.

ANIMAL NUTRITION

Stevia has potential applications as a natural feed additive in livestock and poultry production. It improves feed palatability and is being investigated for its ability to promote growth, improve animal health, and enhance antioxidant status, making it a promising ingredient for sustainable animal.

CONCLUSION

Stevia rebaudiana has emerged as a natural sweetener crops because of its exceptional sweetness, negligible caloric value, and numerous health-promoting properties. Despite challenges associated with conventional propagation, advancements in vegetative propagation and micro propagation techniques have greatly improved the availability of quality planting material for commercial cultivation. Adoption of suitable agronomic practices, including proper soil management, balanced fertilization, irrigation, and optimum planting density, can significantly enhance leaf yield and quality. Owing to its wide range of applications in the food, pharmaceutical, nutraceutical, cosmetic, and livestock industries, stevia offers substantial economic opportunities for farmers and agro-based industries. The favourable agro-climatic conditions prevailing in the Shevaroy Hills make the region highly suitable for Stevia cultivation, offering excellent opportunities for crop diversification, value addition, and sustainable income generation for farmers.. With increasing consumer preference for natural and healthier sugar

substitutes, *Stevia rebaudiana* is expected to play a vital role in sustainable agriculture, value addition, and the development of functional food products in the future.

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