

Stevia farming:

A moneymaking venture for farmers

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India stands first in terms of population, along with rise in population, it also has world's largest diabetic population. Major driving force for diabetes is linked with consumption of sugar or high glycemic rich foods. Stevia is a natural sweetener having nutritional, therapeutic and industrial importance. Stevia is popularly called as 'methi tulsi' by Indian farmers due to its sweet essence. Stevia leaf contains more than 20 steviol glycosides, such as stevioside and rebaudioside, which are 200–300 times sweeter than sucrose. It is widely used as zero calorie sweetener and a substitute for sugar all over the world. Wide range of climatic conditions of our country offers great scope for commercial cultivation of stevia for farming community as it is a perennial crop and gives high returns with B:C ratio of 1.86. Realizing the importance of stevia in global market, Government of India is also promoting this crop by providing technological support and subsidies.

Keywords: Diabetics, Natural sweetener, Rebaudioside, Stevia, Stevioside

STEVIA (*Stevia rebaudiana* Bertoni) belonging to Asteraceae family is native to Paraguay region. The plant is extensively known for its sweetness and low-calorie due to diterpene steviol glycosides (SGs) present in its leaves. The major ones are stevioside and rebaudiosides, which are about 200-300 times sweeter than sugar. Stevia is grown under tropical and sub-tropical conditions. It is basically short-day plant, but long day-length is helpful for higher leaf yield. Relative humidity of 65-80% is suitable for proper growth and development. Stevia grows well in sandy loam soil with pH range of 5.0-7.5 and requires a warm and sunny weather. Soils should be well drained but with reasonable water holding capacity. Madhya Pradesh, Punjab, Andhra Pradesh, Karnataka, Chhattisgarh and Maharashtra are the major stevia growing states in India. The global stevia market size grew from ₹ 61.65 billion in 2022 to ₹ 67.40 billion in 2023 at a compound annual growth rate of 9.9%.

Package of practices

Major cultivars

Him Stevia: IHBT, Palampur has developed improved cultivar with higher proportion of rebaudioside-A (7.34%) compared with stevioside (5.78%) and total glycoside content of 14.49% on dry weight basis.

CIM Madhu: Released by CIMAP, Lucknow, Uttar Pradesh having good stevioside content (12.57%), rebaudioside content (5.80%), fresh leaf yield (133.77 q/ha) and dry leaf yield (43.05 q/ha).

CIM Mithi: Released by CIMAP, Lucknow, Uttar Pradesh having stevioside content of 12% and rebaudioside content of 4%.

Kodaikanal Local, Pune Local, Zaheerabad Local, Indore Local, Hyderabad Local and Bidar Local are farmer's field collections from respective places.

Propagation and planting

Stevia can be propagated by seeds, suckers, stem cuttings and tissue culture. Propagation through seeds is easy and economically

more viable. However, there are morphological and chemical variations among the individual plants of seed raised populations. Clonal propagation through cuttings and tissue culture provides uniform quality of produce, but the cost of planting material is high.

Nursery raising through seeds should be done in the month of January-March. However, it can be grown throughout the year under protected condition. Fertile seeds are dark coloured, while infertile ones are generally pale or clear coloured. Seeds can be sown in plastic trays, pots, wooden boxes or in raised nursery beds having a good mixture of organic manure, soil and sand. For the first five days after sowing, light irrigation should be given daily in the nursery beds, preferably during morning and evening hours and thereafter once a day for next five days. Seed germination takes place in 7-10 days. Two-month-old seedlings at 5-7 leaf stage with 10-15 cm height are suitable for transplanting.

Plants can also be raised by using stem cuttings of 10-15 cm length with 4-6 nodes. The cuttings should be taken from actively growing plants during mild weather avoiding extreme cold or hot months. Lower leaves of the cuttings are trimmed and the cuttings are planted in the bed keeping one node inside the soil. These cuttings should be raised under partial shade and high humidity for fast root development. Water should be sprinkled on daily basis till root formation occurs, which takes 10-15 days. The rooted cuttings are then transferred to sleeves filled with soil, sand and FYM mixture (1:1:1 ratio). These cutting raised plants need to be irrigated twice a week.

Generally, 50-60 days old seedlings with about 15 cm height or rooted cuttings or tissue culture raised hardened plants are transplanted in the field during the months of March-April or June-July avoiding the periods of extreme temperatures. However, the date of transplanting should be adjusted as per the local weather conditions. Transplanting is done in raised beds or flat beds at a spacing of 45 x 45 cm and 45 x 30 cm in high and medium fertile soils, respectively. With 45 x 45 cm spacing, 30,000 seedlings are enough for one acre. Pinching of the apical bud should be done after establishment of plants to enhance bushy growth with lateral branches.

Manures and fertilizers

Stevia requires a moderate level of nutrients. Therefore, among agronomic practices, nutrient management is the most important factor for higher leaf yield and quality of stevia. Fertilizer dose

of 100-120 kg nitrogen, 40-50 kg phosphorus and 50-60 kg potassium per hectare should be applied. For organic farming, well rotten farm yard manure @ 20-30 tonnes/ hectare is required. The requirement of manure and fertilizer depends upon cropping mode and soil fertility status.

Water management

First irrigation is given immediately after transplanting and subsequently after three to five days interval till establishment of the plants. Thereafter, watering up to a depth of 5 cm is done weekly until monsoon rains commence. Regular watering is required during hot summer. Drip irrigation system economizes the irrigation water requirement. Excessive moisture levels can have detrimental effects on the crop because stevia cannot tolerate water-logging. Therefore, proper drainage facility should also be established while preparing the land.

Weed management

Weed growth is the major challenge in stevia cultivation which limits the plant growth and ultimately the crop yield. Stevia plants grow very slow initially and are unable to compete with weeds which come up rapidly due to favourable growth conditions. Therefore, regular weeding is required at 3-week interval during first two months to avoid crop weed competition. Mulching with plant residues or plastic sheet has been found useful in controlling germination and growth of the weeds. It also improves the stevia plant growth.

Plant protection

Young leaves and buds are occasionally attacked by caterpillars, which can be controlled with the spray of cypermethrin/deltamethrin/ quinalphos @ 1.5-2.0 ml/L at 15 days interval. Among diseases, leaf blight caused by *Alternaria* sp. and leaf spot caused by *Septoria steviae* are the most common and mainly occur during rainy season. These diseases reduce stevia leaf yield and quality. Spray of bavistin and dithane M-45 alternately @ 2.0 g/L controls the spread of leaf diseases. Sporadic occurrence of root rot (*Sclerotium rolfsii*) has also been observed during rainy season. For the control of root rot, drenching with bavistin @ 2.0 g/L is recommended. The leaves should be harvested only after 20 days of spray.

Harvesting

Time of harvesting depends on growing season and region. Harvesting should be done manually at 10-15 cm height from the ground level. First harvest is taken at 90-110 days after transplanting. Subsequently, second harvest is taken after 50-65 days of the first harvest before the onset of flowering. In case of late transplanting, single cut is taken after 3-4 months. Since, stevia is a perennial crop, the production may be taken up to 4-5 years from the same plantation.

Post-harvest practices

The harvested crop is dried and the leaves are separated from the stems for further processing. The stems have very low concentrations (1-2%) of steviol-glycosides. Thus, the stems are removed to minimize processing cost. Procedures for drying of leaves and its storage are crucial for fetching suitable market price. Hence, fresh leaf harvest should be dried in shade or hot air oven at 40°C. If the harvested plant material is not dried up quickly, the quality of leaves can deteriorate. The leaves can be further processed for the extraction of steviol-glycosides.

Crop promotion through public and private institutes

Various Institutes and research centers are actively involved in promotion of cultivation of stevia



Stevia seeds



Seed germination in pro-tray



Field view of plant

Source: University of Agricultural Sciences, GKV, Bengaluru

in India. These organizations offer valuable resources such as high-quality planting materials, comprehensive training, awareness initiatives, and expert consultations for those interested in stevia farming. Apart from knowledge-sharing, these institutions also provide loans and subsidies facilities for stevia cultivation viz., National Medicinal Plants Board (NMPB) has declared a 20% subsidy at the expense of stevia production. AYUSH and The National Medical Plant Board jointly offer a subsidy of 30%, a maximum of Rs. 30 lakhs, on the total cost of stevia cultivation. National Horticulture Board offers 40% subsidy. The Centre offers a soft loan at 1% interest rate to those who want to set up a processing plant. Organic Innovation Assam organization gives material for Stevia farming on 100% cashback agreement and provide free of cost training to the farmers on stevia cultivation.

Support extends beyond cultivation into the processing aspect as well. Entrepreneurs seeking to establish stevia processing plants can avail a soft loan with a minimal interest rate of 1%. Furthermore, the Organic Innovation Assam organization takes an innovative approach by providing materials for stevia farming through a 100% cashback agreement. Notably, they also impart invaluable training to farmers regarding stevia cultivation at free of cost.

Marketing facilities

The market for stevia leaves has been expanding steadily due to the increasing demand linked to the rising diabetic population. Despite the absence of local marketing infrastructure compared to other agricultural products, various private companies like Stevia World Agrotech in Bengaluru, Karnataka, and SSP Group of Companies in Udaipur, Rajasthan, engage in contract farming of stevia. Various online platforms like Flipkart, Amazon, Big basket etc. offer a wider reach, enabling farmers to showcase their stevia products to diverse group of customers and facilitating

direct sales to consumers. This approach streamlines the marketing process for stevia leaves and offers farmers more accessible avenues for selling their produce. Additionally, partnerships with food and beverage companies, health-oriented retailers, and wellness brands can offer strategic avenues for reaching target markets. With these marketing facilities at their disposal, stevia farmers can effectively navigate the market landscape and capitalize on the increasing demand for this natural sweetener.

Costs and returns from stevia cultivation

The different components of variable cost and fixed cost of stevia plantation in different years are depicted in Table 1. Average economic life of stevia crop is considered as four years. On an average the farmers incur ₹ 3,74,419 in the first year. The cost of planting material and installation of the drip irrigation system are the major components. The average yield of stevia is 2.5 to 3 tonnes per hectare during the entire crop duration. However, there exists slight variability in the yield of stevia over

Table 1. Cost of cultivation and cost-benefit analysis of stevia (per hectare)

Particular	I Year	II Year	III Year	IV Year
I. Variable cost				
<i>a) Material cost</i>				
Cost of planting material @ ₹ 4/Sapling	197531	9876.54	0	0
Cost of FYM	5000	0	0	0
NPK	3000	2000	4500	1500
Drip irrigation @ ₹ 45000/acre (Charges of pump + Main pipes + laterals for drip)	111150	0	0	0
Subtotal (a)	316681	11876.5	4500	1500
<i>b) Labour cost</i>				
Land preparation (Machine labour) @ ₹ 1200/acre	2964	0	0	0
Application of FYM and NPK @ ₹ 400/Manday	1600	1600	1600	800
Planting/Gap filling @ ₹ 300/Manday	2400	600	0	0
Irrigation @ ₹ 400/Manday	8000	8000	8000	8000
Weeding @ ₹ 300/Manday	1200	900	1200	1200
Harvesting @ ₹ 300/Manday	1500	2400	1800	3000
Interest on working capital @ 6.75%	2272.12	1458	1260	1450
Subtotal (b)	19936.1	14958	13860	14450
Total variable cost (A) = (a) + (b)	336617	26834.5	18360	15950
II. Fixed cost				
Rental value of land	25000	27500	35000	38500
Depreciation @10%	11115	11115	11115	11115
Interest on Fixed capital	1687.5	3861.5	3089.71	3349
Total Fixed cost (B)	37802.5	42476.5	49204.7	52964
Total cost (C)=(A+B)	374419	69311	67564.7	68914
Yield	2500	3000	3000	3500
Price/Kg	90	90	90	90
Gross returns	225000	270000	270000	315000
Net returns	-149419	200689	202435	246086
Total cumulative cost	580209			
Total gross returns	1080000			
Overall net returns	499791			
Average annual net returns	124947.75			
Payback period	2.15			
B:C Ratio	1.86			

the years. The average yield during first, second, third and fourth year is approximately 2.5, 3.0, 3.0 and 3.5 tonnes per hectare, respectively. The average price of the stevia leaves is considered as ₹90 per kg in the current study. The B:C ratio of stevia cultivation is 1.86 indicating the huge potential to improve the livelihood of stevia farmers by means of high profitability. The low payback period and high B:C ratio indicate the project's financial feasibility and potential for sustainable returns over crop period.

SUMMARY

Sweet essence of stevia has been discovered long back and it

is being promoted globally as a sugar substitute crop. However, stevia is still not in the main stream cultivation practices in India as cultivating stevia represents a dilemma for Indian farmers because of lack of awareness, improper guidance, high initial input cost, unavailability of adequate planting material/varieties and inappropriate processing procedures despite its huge profitability potential with B:C ratio of 1.86 indicating the economic viability of the stevia cultivation and its positive returns compared to the costs incurred. The cumulative total cost steadily decreases from the first year to the fourth year, with the project exhibiting a positive

Average Annual Net Return of approximately ₹1,24,947.75. The payback period is estimated at around 2.15 years. However, various public and private institutes are offering quality planting materials, training, awareness programs and consultation for stevia farming and also it is approved by Food Safety and Standards Authority of India for use as an artificial sweetener in various foods. So, it offers a vast scope for commercial cultivation and processing in India in order to boost the income of the farmers and agrarian economy as a whole.

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HANDBOOK OF INTEGRATED PEST MANAGEMENT

To reverse the loss of environmental resources and also to reduce biodiversity loss, the Government of India has Integrated Pest Management (IPM) as part of the National Agricultural Policy. Integrated Pest Management emphasizes the growth of a health crop with the least possible disruption to agro-ecosystems and encourages



natural pest control mechanisms. IPM is not new – mechanical, cultural and biological tactics were used by farmers for hundreds of years before chemical pesticides became available. Besides, there are IPM techniques that have been developed more recently and are effective in suppressing pests without adversely affecting the environment.

The task of spreading the message of IPM across is tough due to poor awareness about the subject among people in line-departments as also among the farmers. The information on integrated pest management as a whole is scattered. This *Handbook* comprehensively deals with all the aspects of integrated pest management in field crops, horticultural crops under traditional, protected systems. Information on basic strategies and tactics of different methods of management including mass production of biocontrol agents, IPM policy and pesticide registration is provided in comprehensive form.

The *Handbook of Integrated Pest Management* comprises 82 chapters which are well written in lucid language with crispy sentences by the renowned scientists. The role of IPM is elucidated with different pests like *Trichogramma*, *Bacillus thuringiensis*, *Nomuraea rileyi* etc. and agricultural crops like rice, wheat, maize, sorghum, pearl millet, pulses, soybean, rapeseed mustard, groundnut, minor-oilseed crops, sugarcane, cotton, jute and mesta, potato, vegetable crops, fruits, grapes, citrus, banana, pomegranate, coconut etc. This *Handbook* will provide information of available useful technologies to educate on how to reduce or

judiciously use chemical pesticides, safeguard ourselves from chronic poisoning, save the National environment while also reducing input costs and raise farmers' income. This compilation will be useful to teachers, students, trainers, line-department personnel and policy makers.

TECHNICAL SPECIFICATIONS

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