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Stevia Cultivation in Punjab: Some Crucial Narratives

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Abstract

Stevia (Stevia rebaudiana Bertoni) is a perennial herbaceous crop belonging to the Asteraceae family. It is a potent medicinal crop cultivated worldwide due to its high economic value as a natural sweetener as well as an alternative to sugarcane. The present study was undertaken to highlight present status and the deterrents perceived by the farmers in the adoption of stevia cultivation in Punjab. The formulations of the study were based on primary data collected from 30 stevia growers for the crop year 2021-22. A purposive sampling technique was used for selection of the study area. Based on the spread of stevia over the state, the respondents of study were from 16 blocks of six stevia niche' districts; Gurdaspur, Hoshiarpur, Jalandhar, Ludhiana, Patiala and Pathankot. The Snow Ball Sampling technique was resorted to in the selection of stevia growers. The analysis showed that the input problems were the most crucial followed by environmental, technological, marketing, and biotic problems. Very high labor requirement leading to high labor cost and exorbitant price of planting material, non-remunerative price of stevia produce were identified as the major deterrents in the way of stevia area expansion, requiring immediate policy attention to encash the potential of stevia. The policy initiatives to increase the viability of the crop can go a long way in promoting stevia cultivation.

Keywords: Problems, Punjab, Stevia (*Stevia rebaundian* Bertoni), Severity index

JEL classification: Q10, Q16, Q13

Introduction

Stevia **(***Stevia rebaudiana* Bertoni) is a perennial herbaceous crop belonging to the *Asteraceae* family (Jitendra *et al,* 2012; Autade and Choudhary, 2015). It is a potent medicinal crop cultivated worldwide due to its high economic value as a natural sweetener and an alternative to sugarcane. Apart from sweet content, stevia has various therapeutic benefits because of its anti-hyperglycemic, anti-cancer, hepatoprotective, antihypertensive, anti-caries, antiulcer, antioxidant, and antimicrobial properties (Hossain *et al*, 2017; Thombare *et al* 2019).

In India, Stevia is well-known as '*Meethi Tulsi*' or '*Madhu Tulsi*' and has gained recognition in the past two decades due to its high demand potential created by a significant rise in the diabetic population in the country. Stevia, traditionally grown in Sikkim, has been successfully cultivated in several parts of the country like Punjab, Maharashtra, Karnataka, Chhattisgarh, Uttar Pradesh, Madhya Pradesh, and Andhra Pradesh. With the intervention of CSIR-IHBT (Institute of Himalayan Bioresource Technology), stevia has been grown over 2050 acres in Punjab, Haryana, and Uttar Pradesh, benefiting 2530 farmers with an estimated employment generation of over two lakh man-days annually in 2017 (Pal *et al,* 2017).

It is perceived that stevia can be the profitable diversification option in Punjab due to its agronomic and economic advantage over the current cropping cycle (paddy-wheat). Stevia has a comparatively lower requirement of water, fertilizer, and pesticides (being insect repellent). Stevia cultivation can be the one to resolve the major farming problems of Punjab i.e. falling groundwater level, increasing soil and water toxicity because of excessive use of chemicals, and mono-cropping rotation (paddy-wheat). Of late, it has been propagated that stevia cultivation may provide a new pathway for the Punjab farmers to get assured and higher income compared to the traditional crop cycle.

Against this backdrop, the present paper gives an overview of the findings of the study, which aimed at mapping the spread of stevia cultivators in Punjab and bringing forth the deterrents in the way of stevia cultivation as perceived by Stevia cultivators.

Data Sources and Methodology

The objectives of the study called for the use of primary data from the stevia growers of Punjab. The present study spanned over the entire state in the stevia cultivation niches

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developed by the stevia processing companies. The cultivation of stevia was concentrated in six districts; namely Gurdaspur, Hoshiarpur, Jalandhar, Ludhiana, Patiala and Pathankot. Since stevia is cultivated on a very negligible area, the selection of stevia growers was proposed to be assisted by the stevia contracting/processing companies operational in Punjab. The Snow Ball Sampling technique was used for the selection of stevia growers. The requisite information from the stevia growers for the crop year 2021-2022 was collected by way of personal interview using a specially structured interview schedule, which was thoroughly pretested to remove the ambiguities in order to get the effective response.

The deterrents in the way of stevia cultivation were identified and categorized into five different groups as input problems, environmental problems, marketing problems, technological problems and biotic problems. For every item in each of the problem sets, the respondents were categorized according to the intensity of the problem faced; namely low, moderate and high. The responses were translated to mean score with a score of 1 for low, 2 for moderate and 3 for high used as weight to find out the mean score. The Severity Index was ascertained by working out mean score attained as percent of maximum attainable score so as to rank order and bring all the problem categories to a common denominator.

Results and Discussion

The study aimed at providing insight into the major narratives of stevia cultivation in Punjab. The process of mapping the stevia cultivators entailed thorough consultation with the stake holders all along the promotion, allurement, technology dissemination, production and up to the last mile i.e. consumption stage of stevia. Virtually each and every stevia grower of the state was contacted, may it be through the contracting agencies, seed supplying agencies or technology dissemination institutes. It is hypothesized that the spread of the sample across districts/ blocks can be treated as a proxy to the scatter of stevia cultivation over the state. The stevia growers were spread over six out of 23 districts of Punjab (Table 1). The 30 stevia growers selected for the study were from 21 villages. These villages happened to be in 16 blocks (two each from District Gurdaspur, Jalandhar and Patiala; three each from District Hoshiarpur and Ludhiana and four from District Pathankot).

A little over one fourth (26.7 %) of the stevia growers were from district Hoshiarpur (Table 2). Three top ranking districts in terms of number of stevia growers as well as acreage were Hoshiarpur, Pathankot, and Ludhiana; together accounting for 70 per cent of growers and 92 per cent of the stevia area under the study conducted for the state of Punjab. Patiala district stood at number four with 13.3 per cent of growers and only 4.6 per cent of stevia area. Gurdaspur district with 8.2 per cent of the study stevia area cultivated by three farmers happened to be fourth in terms of area and fifth in terms of proportion of stevia growers.

Stevia Acreage Details by the Year of Adoption

As has been highlighted in the Table 3, there were only seven (23.3 %) respondents who initiated the stevia cultivation venture in 2017 on on an average area of 4.4 acres. The successive years 2018 and 2019 saw only two

Table 1. Scatter of stevia growers in Punjab

District	Block	Villages	Stevia Growers
Hoshiarpur	10[@]	1385[@@]	8
	3	*3*	
Pathankot	6	358	7
	4	*5*	
Gurdaspur	11	1153	3
	2	*3*	
Jalandhar	11	910	2
	2	*2*	
Ludhiana	13	893	6
	3	*6*	
Patiala	9	893	4
	2	*2*	
Total	16	21	30

[@] *Number of total blocks in the respective district*
[@@] *Number of total villages in the respective district*
**Italicized figures represent the corresponding selection*

Table 2. Stevia adopter- acreage connect in Punjab

Districts	Respondents		Districts	Stevia Area	
	No	% of total		Acres	% of total
Hoshiarpur	8	26.7	Hoshiarpur	63.00	41.5
Pathankot	7	23.3	Pathankot	34.50	22.7
Ludhiana	6	20.0	Ludhiana	27.50	18.1
Patiala	4	13.3	Gurdaspur	12.50	8.2
Gurdaspur	3	10.0	Jalandhar	7.50	4.9
Jalandhar	2	6.7	Patiala	6.90	4.6
Total	30	100.0	Total	151.9	100.0

and three farmers respectively joining in with slightly higher area of 7.0 and 8.5 acres respectively under stevia cultivation. In the recent years, there were as high as 60 per cent of the respondents as the fresh entrants, with 27 per cent initiating stevia cultivation in 2020 on 5.8 acres and another 33 per cent in the most recent past (2021), the stevia acreage being 3.9 acres. Since stevia is a perennial crop with fruition period extending over four to five years, it was considered imperative to enquire about the continuation status of production. Starting with the case of those who started stevia cultivation in 2017, 57 per cent of the respondents didn't bring about change in the area. There was a decline in the area by 3.1 per cent in the case of 2018 starters. The 2019 adopters were found to carry out the operations as such till date. Those who started the stevia cultivation operations in 2020, enhanced the area by 8.6 per cent in the ensuing year.

Deterrents in the Way of Stevia Cultivation

Punjab is looking forward for suitable crop diversification options for its farmers; however no viable option, which can replace rice-wheat rotation in terms of profitability, has yet been found. In an effort to evaluate stevia as a diversification option, it was found imperative to study the constraints in the way of cultivation thereof. The constraints analysis is deemed as a crucial step for the success of stevia crop in Punjab, provided these are studied with the intention of resolution.

It has been observed that majority of the stevia growers were not ready to continue with the stevia cultivation, leave apart increasing the allocation to it. Following is the information provided on severity of various problems, the stevia growers have been experiencing on different fronts.

Technological Problems

The information pertaining to the perception of the stevia growers regarding technological constraints in the way of stevia cultivation has been presented in Table 4. It can well be observed that as many as 70 per cent of the stevia growers were in agreement on non-availability of technical advice on all the aspects of stevia cultivation thereby rendering it as the most compelling constraint with the highest severity index of 85.6 per cent. The complexity of the stevia cultivation practices attained the second position (Index: 80%). Keeping track of the critical stages of stevia cultivation (Index: 66.67%) posed an obstacle of highest degree in the way of 27 per cent of stevia growers, while 47 per cent found this issue as being of moderate severity. The paucity of timely technical advice to the farmers and insufficiency of literature on stevia cultivation in the local language were the other constraints, although less compelling as indicated by

Table 3. Stevia acreage details by the year of adoption in Punjab

Year of adoption	No.	%age	Average area (acres)		Percentage of respondents with change in area		
			To start with	Present	Increase	Decrease	No change
2017	7	23.33	4.4	4.0	14.3	28.6	57.1
2018	2	6.67	7.0	4.8	-	50.0	50.0
2019	3	10.00	8.5	8.5	-	-	100.0
2020	8	26.67	5.8	6.3	12.2	12.5	75.0
2021	10	33.33	3.9	3.9	NA	NA	NA

- : nil
NA : not applicable

Table 4. Incidence of technological problems as reported by stevia growers of Punjab

Problem	Low	Moderate	High	Mean score	Severity Index, %	Rank
Complex cultivation practices	6.7*	46.7*	46.7*	2.40	80.0	II
Access to limited technical advice	13.3	16.7	70.0	2.57	85.6	I
Difficulty in keeping track of the critical stages of cultivation	26.7	46.7	26.7	2.00	66.7	III
Paucity of timely technical advice	30.0	53.3	16.7	1.87	62.2	IV
Insufficient literature on stevia cultivation in local language	50.0	23.3	26.7	1.77	58.9	V

**Percent of respondents*

the severity index of 62.22 and 58.89 per cent respectively. Efforts may be made by the extension specialists to satisfy the farmers regarding the cultivation of stevia through field demonstrations which can go a long way in promoting the crop in the state.

Input Problems

The inputs act as the foundation stone of any production process and particularly so in case of agricultural production. If the input delivery and/or usage is constrained by one reason or the other, the entire production process comes to a creaking halt and the situations like these call for immediate redressal. Various inputs constraints in case of stevia cultivation have been enlisted in Table 5. The perusal of the table highlighted that all the stevia growers were constrained by the high labor requirement at the time of particular farm operations. Since this crop requires frequent manual weeding, meeting the labor requirement poses a formidable challenge. Very high labor cost due to manual weeding and harvesting also had a severity index of 100 per cent. While 'high price of planting material' ranked 3rd with severity index of 92.22 per cent. The other problems in descending order of severity were observed as 'lack of formal credit facilities', 'quality issues with planting material', and 'availability issues in planting material' ranked 4th, 5th and 6th respectively in the severity list of input constraints faced by farmers with severity index of 91.11 per cent, 67.78 per cent and 52.22 per cent respectively.

Marketing Problems

The success of any crop majorly depends upon the marketing forces (supply and demand), its functioning, and availability of marketing places nearby as it builds trust and hope among farmers to cultivate a particular crop. Various marketing constraints faced by the stevia growers have been enlisted in Table 6. The table highlighted that the stevia growers were in consensus that the price paid by the contracting agencies for their produce was not remunerative as they were barely managing to cover their cost of cultivation and it turned out to be major marketing issue with severity index of 91.1 per cent. The market price of stevia produce is totally controlled by the stevia contracting agencies without any regulation as there is no regulated market where it can be sold and all these malpractices can be checked by the respective authorities. The lack of regular market was thus perceived as a major constraint with severity index of 87.8 per cent. While the constraints like 'no option to sell stevia to the end consumer at own level' and 'heavy cuts imposed on quantity or price by contractor company' were ranked third and fourth in the list with severity index showing somewhat

Table 5. Incidence of input problems as reported by stevia growers of Punjab

Particulars	Low	Moderate	High	Mean score	Severity Index, %	Rank
Availability issues in seedling/planting material	50.0	43.3	6.7	1.57	52.2	VI
Quality issues with planting material	20.0	56.7	23.3	2.03	67.8	V
High price of planting material	-	23.3	76.7	2.77	92.2	III
Lack of formal credit facilities	-	26.7	73.3	2.73	91.1	IV
High labor requirement for particular farm operations	-	-	100.0	3.00	100.0	I
Exceptionally high labor cost	-	-	100.0	3.00	100.0	I

- : nil

Table 6. Incidence of marketing problems as reported by stevia growers of Punjab

Particulars	Low	Moderate	High	Mean score	Severity Index, %	Rank
Lack of regular market	-	36.7	63.3	2.63	87.8	II
Price is not remunerative	-	26.7	73.3	2.73	91.1	I
Heavy Cuts imposed on quantity or price by contactor company	16.7	40.0	43.3	2.27	75.6	IV
No option to sell stevia to the end consumer at own level	13.3	36.7	50.0	2.37	78.9	III
Grading issues	73.3	23.3	3.3	1.30	43.3	VI
Quality loss due to improper storage	63.3	30.0	6.7	1.43	47.8	V

- : nil

moderate intensity of 78.9 and 75.6 per cent respectively. Leaves being the final product of stevia cultivation are easy to store and grade after proper sun drying, which ensures the quality of the produce for longer duration without causing much hindrance to the growers thus ranked fifth and sixth with severity index of 47.8 and 43.3 per cent respectively.

Environmental Problems

The environment varies from region to region and also from crop to crop, and when plant achieves the required optimum condition, cultivation of that crop is possible in that region. Sometimes, particular regions are not apt for certain type vegetation but farmers tend to cultivate those crops by altering of certain environmental conditions to achieve higher returns; therefore, it is critical to identify those limiting factors prior to cultivation. Thus various environmental constraints experienced by the stevia growers have been enlisted in Table 7. The 'waterlogging' condition is ranked first by growers with a severity index of 95.6 per cent. It causes fungal disease to plants, which can lead to plant decay; therefore, proper drainage system must be developed in the fields during rainy seasons to avoid waterlogging.

The crop under study is also 'not suitable for water-stressed condition' as plant requires light irrigation in summers at regular intervals depending upon the irrigation system installed and also, the 'high temperature' in summers in the absence of regular irrigation even leads to the crop loss and in extreme cases complete failure of crop thus limiting the farmers profitability. Both these constraints show moderate to high intensity of hindrance to farmers with severity index of 78.9 and 77.9 per cent respectively. While 'low-temperature requirement during the initial stage of the crop' and 'susceptibility to frost damage' have been found to affect the crop with low to moderate intensity as low temperature only leads to growth cessation of plant with severity index of 66.7 and 66.1 per cent and ranked fourth and fifth respectively.

Biotic Problems

The perusal of the Table 8 highlighted the various biotic constraints faced by stevia growers in Punjab. The majority of stevia growers had reported weeds as the main biotic constraint confronting them while raising the crop and ranked it first with a high severity index of 97.8 per cent. Due to the perennial nature of crop, stevia crop has to compete with all types of grass, broad leaf plants and other weeds throughout the year but mainly in rainy season. Attack by insect-pests and diseases is minimal, stevia being a medicinal plant has resistance to most of these and hence doesn't cause much of a problem to the growers with a severity index of 55.6 and 46.7 per cent respectively.

Table 7. Incidence of environmental problems as reported by stevia growers of Punjab

Problem	Low	Moderate	High	Mean score	Severity Index, %	Rank
Low temperature requirement during initial stage of crop	16.7	66.7	16.7	2.00	66.7	IV
Susceptible to frost damage	23.3	70.0	6.7	1.83	61.1	V
High temperature	6.7	53.3	40.0	2.33	77.8	III
Waterlogging	-	13.3	86.7	2.87	95.6	I
Unsuitable for water stressed conditions	10.0	43.3	46.7	2.37	78.9	II

- : nil

Table 8. Incidence of biotic problems as reported by stevia growers of Punjab

Problem	Low	Moderate	High	Mean score	Severity Index, %	Rank
Diseases	60.00	40.00	0.00	1.40	46.7	III
Insect-pest	46.67	40.00	13.33	1.67	55.6	II
Weeds	0.00	6.67	93.33	2.93	97.8	I

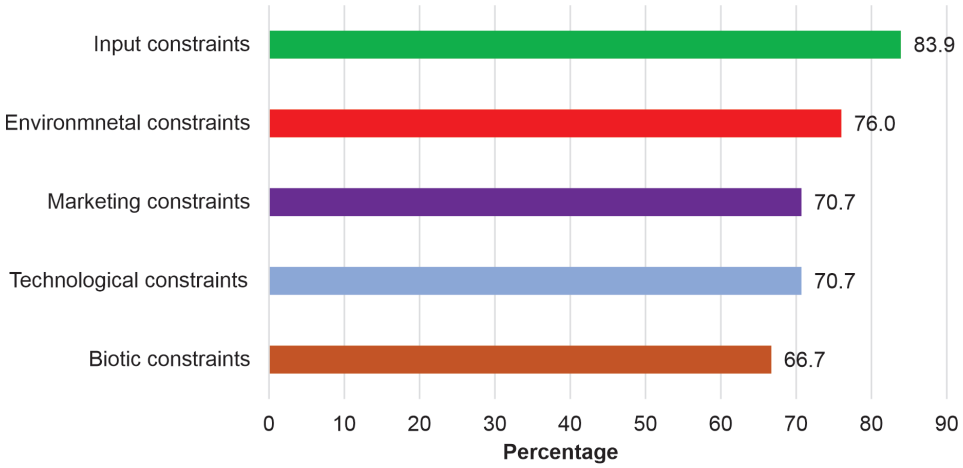

Fig. 1. Severity of problems as reported by stevia growers

Problem Heads Arrayed in Order of Severity

Stevia growers have reported various constraints which they faced from time to time, starting from very beginning till the marketing of the crop.

A perusal of the figure 1 highlighted various categories of constraints and among these, input constraints were the major ones encountered by the stevia growers with overall severity index of 83.9 per cent. The high labor requirement for farm operations and high cost of seedling were the major components of the input constraints faced by the stevia growers. Next to the input constraints are the environmental constraints; mainly waterlogging, water stressed condition and high temperature, which affect the stevia cultivation, with severity index of 76 per cent. The severity with which the technological and market constraints were affecting the stevia growers has been recorded at 71 per cent. Limited technical advice and complex cultivation practices were the top two attributes of technological constraints, while the lack of regular market and prices being less remunerative were the major marketing constraints. On the other hand, the biotic constraints affecting stevia growers were having low to moderate severity, the index value being 66.7 per cent.

Conclusions and Policy Implications

The present paper has brought forth the current status of stevia cultivation in Punjab, which portrays the unwillingness of the majority of stevia growers to continue with the stevia cultivation as it is fraught with so many deterrents. There can be a few policy initiatives, if carried on with the true intent of stevia promotion can go a long way in popularizing stevia cultivation. Directing efforts towards cutting down the seedling cost, developing selective herbicides to cut down the high labor cost on weeding operations and mechanizing the transplanting, weeding and harvesting operations to arrest the high hired labor cost can help in enhancing the viability of the stevia crop. The installation of processing units to add the value to the produce may help in promoting the popularity of stevia crop.

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