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Evaluation of sweet potato (*Ipomoea batatas* (L.) Lam.) genotypes for sensory quality and tolerance to Sweet Potato Leaf Curl Virus (SPLCV) under eastern Indian conditions

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Abstract

Sweet potato (*Ipomoea batatas*) is an important tuber crop having high importance due to its nutritional richness and ability to grow in the abnormal drought and salinity conditions with minimum care and cultivation practices. However, consumer preference is mainly based on the sensory quality, while its production was mostly declined due to the sweet potato leaf curl virus (SPLCV) which remained as one of the major constraints. The present investigation was carried out in the regional station, Central Tuber Crops Research Institute (CTCRI), Bhubaneswar, Odisha, during the rabi season 2025-2026 to identify the genotypes which having both promising eating quality and are tolerant to SPLCV. Thirty-five sweet potato genotypes were evaluated by adapting the randomized block design with two replications. Sensory evaluation of boiled tubers was carried out by eight semi-trained judges using a nine-point hedonic scale for colour, texture, taste, flavour and over all acceptability. Field screening for SPLCV was performed using disease severity, disease incidence and Percentage Disease Index (PDI). Significant variability was observed between the genotypes for both sensory attributes and Tolerance to SPLCV. Among all the evaluated genotypes SP 95/4 recorded the highest for almost all the sensory attributes indicating outstanding consumer preference, Bhu krishna was having highest flavour and SB 537/16 was having the second most overall acceptability. Screening for SPLCV identified DPS/30 (PDI 6.20), DPS/31 (6.80), SB537/16 (7.40), SP 95/4 (8.10), DPS/34 (8.30), VII (8.50) and Bhu Krishna (9.00) as tolerant genotypes with comparatively lower disease incidence. Among all the genotypes evaluated, SP 95/4 emerged as the most promising by combining outstanding sensory quality with effective tolerance to SPLCV. Likewise, DPS/30, VII, SB537/16 and Bhu Krishna demonstrated desirable disease tolerance together with acceptable sensory characteristics, making them valuable candidates for commercial cultivation and future sweet potato breeding programmes aimed at improving consumer acceptance and virus resistance.

Keywords: Sweet potato, Sweet potato leaf curl virus (SPLCV), genotype evaluation, sensory quality, disease resistance, percentage disease index

Introduction

Sweet Potato (*Ipomoea batatas* (L.) Lam) is a dicotyledonous crop that belongs to the family of Convolvulaceae (Barkessa, 2018) [5]. It originated from the Central or southern America region and it is recognized as the primary center of genetic diversity (Austin, 1978) [4]. It was domesticated in tropical America around 6000 BC and later spread to Polynesia, Hawaii and New Zealand before the Columbus times and later it was introduced to Philippines by the Spanish in the 16th century from where it was spread to Asia, Portuguese travellers have introduced it to Europe, Africa, India and Southeast Asia (Yen, 1976) [17]. It is rich in β -carotene and anthocyanins, which have been used for the extraction of food colourants (Bovell-Benjamin, 2006) [6]. Sweet potato is considered a highly valuable crop due to its exceptional nutritional content and its ability to yield more food per hectare compared to other crops (George *et al.*, 2024) [10]. Its starch can be used for the preparation of food, industrial products and biofuel preparation (Lyu *et al.*, 2020) [15]. It is cultivated across 119 countries worldwide, covering a total area of 92,020 hectares and yielding approximately 86.41 million metric tonnes (FAO, 2022) [9].

China leads globally in sweet potato cultivation, accounting for 36.54% of the total area and contributing 63.64% to the global production. In India it is generally called as “Shakarkand” and is grown on about 106,000 hectares, with an annual output of 1,121,000 tonnes (FAO, 2022) [9].

Consumer preference is one of the most important factors determining the adoption and commercial success of sweet potato varieties. Sensory characteristics such as colour, taste, flavour, texture and overall acceptability largely influence consumer choice and market demand. Therefore, sensory evaluation has become an integral component of varietal evaluation and breeding programmes. Ellong *et al.* (2014) [8] reported significant variation among sweet potato genotypes for sensory attributes, suggesting ample scope for selecting consumer-preferred cultivars. Similarly, Hernández *et al.* (2024) [13] observed considerable diversity in physicochemical and organoleptic characteristics among sweet potato landraces, highlighting the importance of sensory evaluation in identifying superior genotypes.

Sweet potato production is severely constrained by viral diseases, among which Sweet Potato Leaf Curl Virus (SPLCV) is one of the most economically important. SPLCV belongs to the genus *Begomovirus* and is transmitted by the whitefly (*Bemisia tabaci*). Since sweet potato is propagated vegetatively, infected planting materials facilitate rapid virus spread and accumulation over successive generations (Clark *et al.*, 2012; Andreason *et al.*, 2021) [7, 2]. Infection results in leaf curling, chlorosis, vein thickening, stunted growth and considerable reductions in storage root yield and quality (Hou *et al.*, 2020) [14]. Previous studies have demonstrated significant variability among sweet potato genotypes for SPLCV incidence and disease severity, indicating the presence of valuable sources of resistance. Arkorful *et al.* (2015) [3], Abebe *et al.* (2023) [1], Griyaningsih *et al.* (2023) [11] and Yusuf *et al.* (2024) [18] reported differential responses of sweet potato genotypes to SPLCV and emphasized the importance of identifying resistant genotypes for sustainable disease management and resistance breeding. Although several studies have evaluated sweet potato genotypes for either sensory attributes or resistance to viral diseases, information on genotypes combining superior eating quality with tolerance to Sweet Potato Leaf Curl Virus (SPLCV) under eastern Indian conditions remains limited. Identification of such genotypes is essential for developing cultivars that satisfy both consumer preference and field performance, thereby enhancing productivity and market acceptance. Therefore, the present investigation was undertaken to evaluate thirty-five sweet potato genotypes for sensory quality and tolerance to Sweet Potato Leaf Curl Virus (SPLCV) and to identify promising genotypes suitable for utilization in future crop improvement programmes.

Materials and Methods

The experiment was conducted at the Regional Station, ICAR-Central Tuber Crops Research Institute, Bhubaneswar, Odisha, India. This experimental area is located in the eastern coastal region of India. The experimental site located at an elevation of 45 m above mean sea level (20.40°N latitude, 85.78°E longitude), featured sandy loam soil. Thirty-five sweet potato genotypes collected from different sources were evaluated under field conditions. The experiment was laid out in a Randomized Block Design (RBD) with two replications following the

recommended package of practices for sweet potato cultivation. Healthy vine cuttings of each genotype were planted at a spacing of 60×20 cm, and all intercultural operations were carried out uniformly throughout the crop growth period. Freshly harvested storage roots from each genotype were washed thoroughly and boiled until adequately cooked. The boiled roots were peeled and cut into uniform pieces before evaluation. Sensory evaluation was carried out by a panel of eight semi-trained judges, comprising scientists and technical staff of ICAR-CTCRI, Regional Station, Bhubaneswar. The samples were evaluated for colour, taste, flavour, texture and overall acceptability using a 9-point hedonic scale following Ranganna (2008) [16] (Table 1). The hedonic scale ranged from 9 (like extremely) to 1 (dislike extremely). The mean score for each sensory attribute was used for statistical analysis. The experimental genotypes were screened under natural field conditions for their reaction to Sweet Potato Leaf Curl Virus (SPLCV). Disease assessment was based on visual observation of characteristic symptoms such as leaf curling, chlorosis, vein thickening and leaf deformation. Five representative plants from each plot were randomly selected and tagged for recording disease observations. Disease severity was assessed using the 0-5 disease rating scale proposed by Hahn *et al.* (1981) [12], where 0 = no visible symptoms; 1 = very mild symptoms; 2 = mild symptoms; 3 = moderate symptoms; 4 = severe symptoms; and 5 = very severe symptoms. The Percentage Disease Index (PDI) was calculated using the following formula

Percentage disease index (PDI)

The Percentage Disease Index (PDI) was calculated to quantify the overall disease severity in percentage form based on the disease rating scale. Disease severity scores recorded from individual plants were used for computation. The PDI was calculated using the following formula

$$\text{PDI} = \frac{\sum \text{of all disease scorings}}{\text{Total number of plants assessed} \times \text{maximum grade}} \times 100$$

Where the maximum grade is 5 as 0-5 scale is used.

Disease incidence (%)

Disease incidence was recorded to determine the proportion of plants infected with the disease under field conditions. Observations were taken at regular intervals (30 DAP and 60 DAP) by visually inspecting all plants in each experimental plot. The total number of diseased plants and the total number of plants observed were recorded and expressed in percentage. It is calculated by using this formula.

$$\text{Disease incidence(\%)} = \frac{\text{Number of infected plants}}{\text{Total number of plants observed}} \times 100$$

Results and Discussion

Sensory evaluation of sweet potato genotypes

Considerable variation was observed among the thirty-five sweet potato genotypes for colour, taste, flavour, texture and overall acceptability, indicating substantial genetic diversity for eating quality (Table 2). Overall acceptability scores ranged from 4.7 to 7.2, while colour, taste, flavour and texture scores varied from 5.8 to 7.6, 5.4 to 7.1, 5.5 to 7.3 and 5.1 to 8.0, respectively. The observed variation suggests

that sensory characteristics are strongly influenced by the genetic makeup of the genotypes and provide ample scope for selecting cultivars with superior eating quality.

Among the evaluated genotypes, SP 95/4 recorded the highest scores for colour (7.6), taste (7.1), texture (8.0) and overall acceptability (7.2), whereas Bhu Krishna registered the highest flavour score (7.3). Similarly, SB537/16 exhibited high consumer preference with an overall acceptability score of 7.0. In contrast, genotypes such as 811, SB BPLR/47 and 527 recorded comparatively lower overall acceptability scores, indicating poor consumer preference.

The superior sensory performance of SP 95/4, Bhu Krishna and SB537/16 may be attributed to favourable genetic differences affecting storage root composition, including starch characteristics, sugar accumulation, dry matter content and other quality attributes that influence colour, flavour, texture and palatability after cooking. These characteristics are major determinants of consumer preference and market acceptance of sweet potato cultivars. Similar findings were reported by Ellong *et al.* (2014) [8], who observed considerable variability in sensory attributes among sweet potato genotypes and highlighted the importance of organoleptic evaluation in identifying consumer-preferred cultivars. Likewise, Hernández *et al.* (2024) [13] reported significant differences in the physicochemical and nutritional characteristics of sweet potato landraces, which contributed to variation in their eating quality.

Overall, the results demonstrate that sensory evaluation is an effective approach for identifying sweet potato genotypes with superior eating quality. The substantial variability observed among the evaluated genotypes provides valuable opportunities for selecting cultivars with enhanced consumer acceptability and for their utilization in sweet potato quality improvement programmes. Although several genotypes exhibited superior sensory attributes, their suitability for cultivation also depends on their tolerance to major diseases such as Sweet Potato Leaf Curl Virus (SPLCV). Therefore, the same genotypes were further evaluated for their reaction to SPLCV under field conditions.

Screening of sweet potato genotypes for SPLCV tolerance

Considerable variation was observed among the thirty-five sweet potato genotypes for Percentage Disease Index (PDI), disease severity and disease incidence, indicating the presence of substantial genetic variability for tolerance to Sweet Potato Leaf Curl Virus (SPLCV) (Table 3). The PDI ranged from 6.2 to 41.6%, disease severity from 0.3 to 2.1, and disease incidence from 14.8 to 60.3%, reflecting marked differences in the response of the genotypes to natural SPLCV infection under field conditions. Among the evaluated genotypes, DPS/30 recorded the lowest PDI (6.2%), followed by DPS/31 (6.8%), SB537/16 (7.4%), SP 95/4 (8.1%), DPS/34 (8.3%), VII (8.5%) and Bhu Krishna (9.0%), indicating a relatively higher level of tolerance to

SPLCV. These genotypes also exhibited lower disease incidence, ranging from 14.8 to 18.8%, compared with the remaining entries. Conversely, Ganjam Local, SB BPLR/47, Dhenkanal Local-2, SB 131/76, MEGH-20, BX35 and BASTAR-42 recorded comparatively higher PDI and disease incidence values, suggesting greater susceptibility to SPLCV infection.

The differential response of the genotypes to SPLCV may be attributed to inherent genetic variation governing host resistance mechanisms that restrict virus infection, multiplication and symptom development. Since sweet potato is predominantly propagated vegetatively, the use of infected planting material facilitates the perpetuation and spread of viruses, making host-plant resistance one of the most economical and environmentally sustainable strategies for disease management. Similar variability in SPLCV response among sweet potato genotypes has been reported by Arkorful *et al.* (2015) [3], Abebe *et al.* (2023) [1] and Griyaningsih *et al.* (2023) [11], who identified resistant and susceptible genotypes based on disease incidence and severity under field conditions. Likewise, Hahn *et al.* (1981) [12] emphasized the importance of exploiting genetic resistance as a practical approach for minimizing yield losses caused by virus complexes in sweet potato. The observed variability for SPLCV tolerance provides valuable genetic resources for resistance breeding and varietal improvement programmes. Genotypes exhibiting lower disease severity and PDI may serve as potential donor parents for developing high-yielding cultivars with enhanced virus tolerance, thereby contributing to sustainable sweet potato production.

When the results of sensory evaluation (Table 2) and SPLCV screening (Table 3) were considered together, SP 95/4 emerged as the most promising genotype, combining superior sensory quality with relatively low PDI (8.1%) and disease incidence (17.9%). Similarly, SB537/16 and Bhu Krishna exhibited desirable eating quality along with comparatively higher tolerance to SPLCV. In contrast, DPS/30, DPS/31 and VII recorded the lowest PDI values, indicating their potential as valuable genetic resources for improving SPLCV tolerance in sweet potato breeding programmes. These findings demonstrate that simultaneous evaluation of consumer-preferred quality traits and disease tolerance is an effective approach for identifying superior sweet potato genotypes for future crop improvement.

Table 1: Nine-point hedonic scale used for sensory evaluation of sweet potato genotypes

Score	Degree of liking
9	Like extremely
8	Like very much
7	Like moderately
6	Like slightly
5	Neither like nor dislike
4	Dislike slightly
3	Dislike moderately
2	Dislike very much
1	Dislike extremely

Table 2: Mean sensory evaluation scores of thirty-five sweet potato (*Ipomoea batatas* (L.) Lam.) genotypes based on a 9-point hedonic scale.

Sl. No.	Genotypes	Colour	Taste	Flavour	Texture	Overall acceptability
1	811	6.5	5.5	6.5	6	4.6
2	527	7	5.4	6.8	5.5	4.9
3	497	5.8	6	6.9	5.7	5.1
4	347	6.9	5.9	5.4	5.9	6.2
5	S-187	6.1	6.1	5.5	5.1	5.9
6	VI	6.4	6.7	6.5	6.2	6.1
7	Ganjam local	6.3	6.9	6.7	6.1	6
8	SB BPLR/46	7.2	6.5	6.1	6	6.2
9	SB 131/76	6.8	6.6	6.2	5.9	5.9
10	SB 5/61	5.9	6.3	6.8	6.4	6.2
11	DPS/34	6.1	6.2	6.7	6.3	6.3
12	BASTA-42	5.8	6.6	6.1	5.7	5.6
13	SB BPLR/47	6	5.9	5.8	5.6	4.7
14	DPS/30	6.9	5.5	6.1	6.6	6.5
15	DPS/31	6.3	6.2	6.4	6.1	6.4
16	BX25	6.2	5.7	5.9	6	6
17	BP-2	6.1	5.8	6.1	6.1	6.1
18	MEGH-20	6	5.7	5.9	6.1	6
19	SB 195/115	6.8	6.8	6	6.4	6.5
20	BASTAR-11	6.1	5.8	6.6	5.8	5.6
21	313	5.9	5.6	5.5	6	5.4
22	X-79	5.8	5.6	5.8	6.2	6.3
23	SB OP5/42	6.3	5.4	5.6	6.9	6.7
24	DPS-33	6.4	6.1	6.2	6.8	6.6
25	BX35	5.9	5.5	5.9	5.8	6.1
26	VII	6	5.7	6	6.3	6
27	SB537/16	6.1	5.9	6.3	6.7	7
28	238	6.1	6.5	6.7	6.4	6.8
29	Kishan	6.5	6.4	6.4	6.2	6.7
30	Dhenkanal Local-2	6.6	6.1	6.7	5.9	6.5
31	SB 223/85	6.2	6.2	6.6	7.2	6.8
32	BX102	6.5	6.1	6.3	7	6
33	101	6.2	6.1	6.4	6.9	6.2
34	SP 95/4	7.6	7.1	7	8	7.2
35	Bhu krishna	6.8	6.6	7.3	7.6	6.8

Table 3: Disease severity, Percentage Disease Index (PDI) and disease incidence of thirty-five sweet potato (*Ipomoea batatas* (L.) Lam.) genotypes under natural Sweet Potato Leaf Curl Virus (SPLCV) infection.

Sl. No.	Genotype	Percentage disease index (PDI)	Disease severity (0-5 scale)	Disease incidence %
1	811	31.8	1.6	47.6
2	527	29.45	1.5	44.8
3	497	18.4	1	30.2
4	347	14.6	0.85	24.7
5	S-187	34.9	1.8	50.5
6	VI	33.7	1.7	51.8
7	Ganjam local	41.6	2.1	60.3
8	SB BPLR/46	32.9	1.7	48.4
9	SB 131/76	37.8	1.7	54.6
10	SB 5/61	11.7	1.9	21.9
11	DPS/34	8.3	0.6	17.6
12	BASTA-42	35.5	0.4	52.7
13	SB BPLR/47	39.8	1.8	57.9
14	DPS/30	6.2	2	14.8
15	DPS/31	6.8	0.3	15.9
16	BX25	33.5	1.7	49.7
17	BP-2	31.9	1.6	47.9
18	MEGH-20	36.8	1.9	55.1
19	SB 195/115	10.4	0.5	19.8
20	BASTAR-11	34.6	1.8	52.1
21	313	32.8	1.7	48.9
22	X-79	33.9	1.7	50.2
23	SB OP5/42	10.56	0.5	20.7
24	DPS-33	9.1	0.4	18.3
25	BX35	35.8	1.8	53.4
26	VII	8.5	0.4	17.2
27	SB537/16	7.4	0.3	15.1
28	238	34.7	1.8	51.6
29	Kishan	13.8	0.7	25.4
30	Dhenkanal Local-2	38.9	2	56.8
31	SB 223/85	9.25	0.4	18.5
32	BX102	30.7	1.6	46.2
33	101	11.8	0.6	22.4
34	SP 95/4	8.1	0.4	17.9
35	Bhu Krishna	9	0.4	18.8

Conclusion

The present study revealed considerable genetic variability among the thirty-five sweet potato genotypes for sensory quality and tolerance to Sweet Potato Leaf Curl Virus (SPLCV). Among the evaluated genotypes, SP 95/4 emerged as the most promising by combining superior sensory attributes with relatively low disease severity, PDI and disease incidence. SB537/16 and Bhu Krishna also exhibited favourable eating quality along with comparatively higher tolerance to SPLCV, whereas DPS/30, DPS/31 and VII were identified as valuable sources of virus tolerance for future resistance breeding. These findings provide useful information for the selection of superior sweet potato genotypes and support breeding efforts aimed at developing cultivars with enhanced consumer acceptability and improved SPLCV tolerance. Further multilocation evaluation is recommended to validate the performance and stability of the identified promising genotypes under diverse agro-climatic conditions.

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Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have influenced the work reported in this paper.

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