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Performance of promising sweet potato genotype NSP-7 in South Gujarat

Himani B. Patel[1*], C. G. Intwala[1], Kiran P. Suthar[1], Nilima Karmakar[2] and G. B. Desai[1]

[1]ASPEE College of Horticulture, [2]N. M. College of Agriculture,Navsari Agricultural University, Navsari, Gujarat, India

Abstract

Sweet potato has a great potential for productivity and energy output. The demand for sweet potato is increasing due to nutritional concerns leading to the availability of diverse genotypes for tuber colour, taste, quality parameters *etc.* In present study, one promising genotype NSP-7, was identified with higher tuber yield (23.39 t ha^{-1}), resistance to sweet potato weevil and slight pink skin colour having pale yellow flesh suitable for cultivation in south Gujarat, India. The morphological, biochemical and molecular analysis revealed NSP-7 as distinct genotypes. It has a high amount of starch (17.28%), fibre (3.97%) and protein (1.68%) as well as good cooking quality as compared to checks. Based on quality parameters and yield performance over the years and location, the NSP-7 genotype is recommended for cultivation in the south Gujarat region for maximum economic benefits.

Keywords : Sweet potato, NSP-7, Sweet potato weevil, Yield, Organoleptic score

Introduction

Sweet potato has traditionally been recognized as a "poor person's crop" or "orphan crop," and it has attracted limited attention compared to other staple food crops. However, during the last decade, this perception has changed, and it is widely used to fight against malnutrition and hunger in the developing world. Sweet potato, *Ipomoea batatas* (L.) Lam. is an important crop belonging to the family Convolvulaceae. It is a natural hexaploid (2n=6x=90), having the basic chromosome number x=15. Its origin is South America. The enlarged adventitious roots produce underground tubers of varying shapes and colours. It is vegetatively propagated from vine cuttings taken from freshly harvested vines from the second nursery. It is known as the Irish potato or White potato. It is also known as a famine relief crop as it played a pivotal role in the Bengal famine of 1942.

Sweet potato is the seventh most important food crop in the world in terms of production. India and China are the leading sweet potato-growing countries in the world. Asia is the largest producer of sweet potato having 92% of production and 80% of area in the world. In India, it is commercially cultivated in Odisha, West Bengal, Uttar Pradesh, Madhya Pradesh, Chhattisgarh, Karnataka, Assam, Nagaland, Meghalaya, Bihar, Tamil Nadu, Kerala, Maharashtra and Gujarat. In India, the area under sweet potato is 1.06 Lakh ha, with an annual production of 10.87 Lakh tonnes, having productivity of 10.3 t ha^{-1}. Though the data on area, production and productivity of Gujarat is not available it occupies approximately more than 1500 ha area. It is commercially cultivated in the districts of South and Middle Gujarat consisting of Valsad, Navsari, Dangs, Surat, Tapi, Kheda, Nadiad, and Ahmedabad.

Efforts were made by AICRP on Tuber Crops, Vegetable Research Farm, Navsari to identify and develop high yielding genotypes with relatively lesser pest problems, suitable for south Gujarat conditions. For this purpose, superior entries were selected from existing germplasm

*Corresponding author Email: hbpguj@gmail.com; Ph: +91 7016379078

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and evaluated in different trials during the year 2018 to year 2023 at Navsari, Paria and Waghai locations. Here, the performance of promising sweet potato genotype NSP-7 in south Gujarat is reported for yield, quality and consumer preference.

Materials and Methods

The promising genotype NSP-7 was tested across the South Gujarat region during the year 2018 to 2023 in the *Rabi* season at Navsari, Paria and Waghai locations. The experiment was conducted in a Randomized block design with three replications. The experimental site/land was prepared by deep tillage and thereafter farmyard manure was added as per the recommended dose. For recording different field observations, five plants were selected randomly in the beginning and tagged with the labels. The analysis of variance was done following Panse and Sukhatme (1967). DNA profiling was done using ISSR markers as per standard method (Moulin et al., 2012).

Results and Discussion

Looking at the tuber yield performance of sweet potato genotypes, NSP-7 genotypes gave a higher yield (23.39 t ha^{-1}) among its check varieties *i.e.,* Gouri (11.83 t ha^{-1}) and Bhu Kanti (21.33 t ha^{-1}) in all the three locations (Navsari, Paria and Waghai) of south Gujarat and were found to be significant during all the year *i.e.*, 2018 to 2023 (Fig. 1). Concerning the quality criteria, NSP-7 differs significantly from Gouri and Bhu Kanti check varieties in terms of total starch (17.28%), fiber (3.97%), and protein (1.68%) (Fig. 2). Using a nine-point hedonic scale, it was found that the appearance, flavor, fibrousness, sweetness, texture, and mouthfeel of tubers of NSP-7 were all noticeably different from the check variety. The overall acceptance score of NSP-7 was 7.67, Gouri scored 7.22, and Bhu Kanti scored 7.07 (Fig. 3).

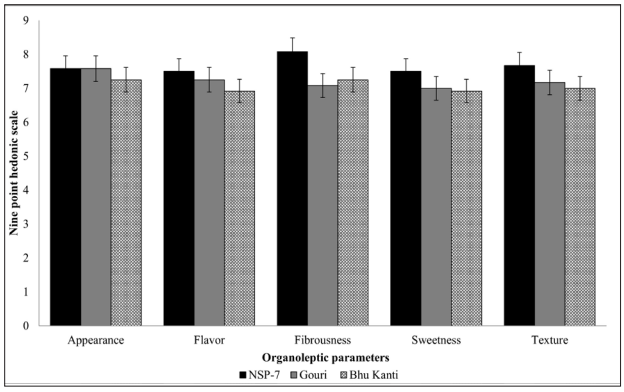

Fig. 1. Comparative yield performance of sweet potato genotypes at different locations

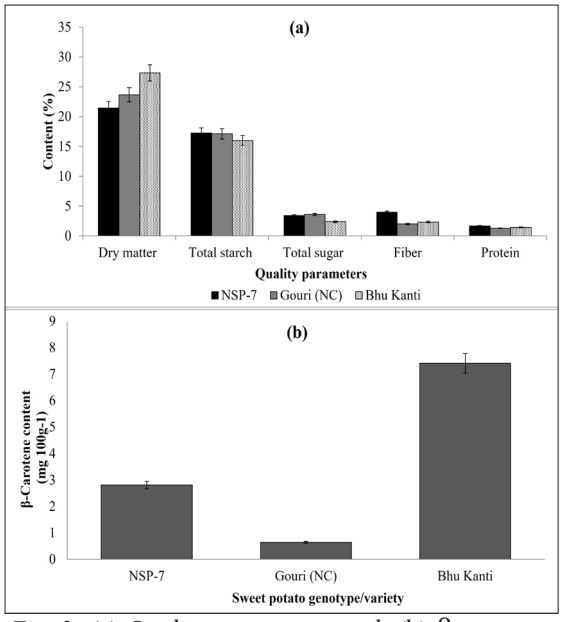

Fig. 2. (a) Quality parameters and (b) β-carotene content in sweet potato genotype/varieties

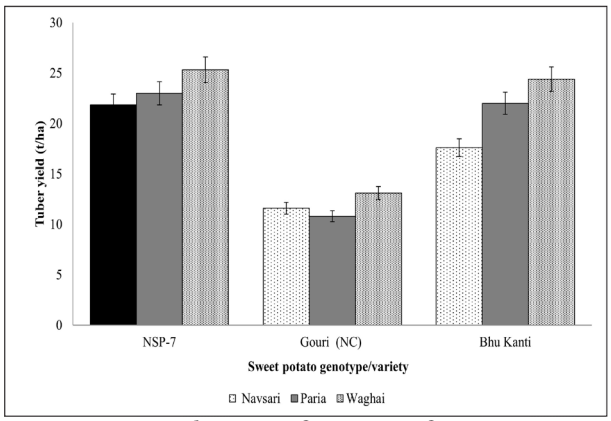

Fig. 3. Organoleptic performance of sweet potato genotype

Population of sweet potato weevil was recorded negligible at Navsari, Waghai and Paria centre during the year 2018, 2019, 2020, 2021, 2022 and 2023. The genotype, NSP-7 showed a very low prevalence of sweet potato weevil among all genotype/varieties over the locations during the study (Table 1). The accession also has distinct tuber characteristics like pale/cream yellow flesh and pale pink skin (Fig. 4).The beta carotene content (2.81 mg 100 g^{-1}) placed this genotype into the category of a slightly biofortified range. The unique characteristics of the sweet potato genotype NSP-7, as described in Table 2, distinguish it from the check varieties Gouri and Bhu Kanti.

The ISSR primer UBC 817 generated a prominent band of 1417bp in Bhu Kanti and NSP-7, which was absent in Gouri. The ISSR primer UBC 807 generated prominent bands of 1201 and 987bp in Bhu Kanti and Gouri, which were absent in NSP-7. The unique band of 590bp

Table 1. Performance of the sweet potato genotype/varieties against sweet potato weevil

Insect/pest	Experiment & Year	Location	% Sweet potato weevil damage		
			NSP-7	Gouri (NC)	Bhu Kanti
Sweet potato weevil	PET, 2018-19	Navsari	7.84	9.52	-
	PET, 2019-20		9.80	9.09	-
	PET, 2020-21		8.33	10.20	-
	SSVT, 2021-22		9.43	8.88	-
	LSVT, 2022-23		9.26	10.20	9.75
	SSVT, 2021-22	Paria	9.61	10.00	-
	LSVT, 2022-23		9.25	10.20	10.00
	LSVT, 2022-23	Waghai	9.80	9.30	9.52

Table 2. Description of morphological /botanical characters of sweet potato genotype/varieties

Sl. No.	**Characteristic**	**NSP-7**	**Gouri (NC)**	**Bhu Kanti**
1	Plant growth habit (cm)	Semi erect	Spreading	Semi erect
2	Vine pigmentation	Green with purple spots	Green	Green
3	Vine tip pubescence	Sparse	Sparse	Moderate
4	Mature leaf shape	Triangular	Lobed	Hastate
5	Immature leaf colour	Mostly purple	Purplish Green	Dark Green
6	Mature leaf colour	Green	Green	Green
7	Tuber shape	Elliptic	Spindle	Elliptic
8	Tuber flesh colour	Cream yellow	Yellowish orange	Orange white

Fig. 4. Plant and tuber characteristics of sweet potato genotype NSP-7

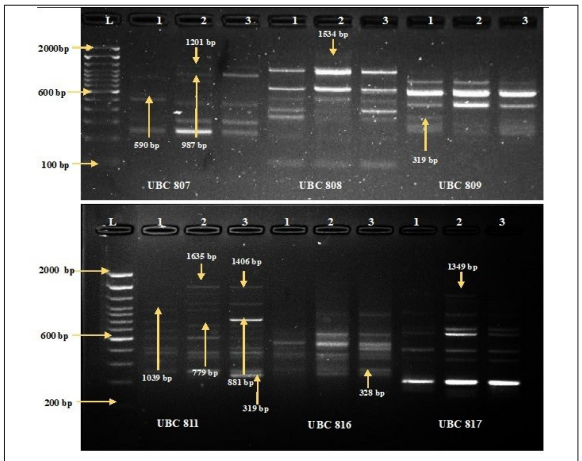

Fig. 5. ISSR profiling of sweet potato by primers UBC 807, UBC 808, UBC 809, UBC 811, UBC 816 and UBC 817 (L-100bp ladder, 1- NSP-7, 2 - Bhu Kanti, 3- Gouri)

in NSP-7 which was absent in Bhu Kanti and Gouri, was amplified. The ISSR primer UBC 808 generated prominent bands of 1534bp in Gouri and Bhu Kanti, which was absent in NSP-7. A unique band of 319bp was observed in NSP-7 with the ISSR primer UBC 809, but it was absent in Bhu Kanti and Gouri. The ISSR primer UBC 811 generated prominent bands of 1635, 1406, 881 and 779bp in Bhu Kanti and Gouri, but it was absent in NSP-7. The band of 319bp generated by UBC 811 in Gouri was not observed in Bhu Kanti and NSP-7. UBC 816 generated a prominent band of 328bp in Bhu Kanti and Gouri, that was absent in NSP-7, whereas UBC 817 generated a band of 1349bp in NSP-7 and Bhu Kanti, that was absent in Gouri (Fig. 5).

Considering the field performance of tested entries of sweet potato, NSP-7 performed better over the years and will be suitable for cultivation in south Gujarat in

different environments due to stable yield performance. Sweet potato has more leaves that increase its net carbon assimilation rate and contribute to better formation of biological yield in terms of tuber yield. The yield performance of genotypes is genetically governed and under optimum environmental conditions, it will lead to better performance. In this study, NSP-7 performed better than the national check reflecting its optimum genetic composition for performance under south Gujarat conditions. Likewise, a comparable yield trend was also found by Verma et al., (1994), Islam et al., (2002), Malshe (2014), Mohanta et al., (2016) Karan and Sanli (2021) and Hejjegar et al., (2023). Sweet potato genotype quality attributes reported in this study are in close agreement with earlier reports by Mohanta et al., (2016) and Karan and Sanli (2021).

Generally, assessment of yield and quality characteristics of different genotypes/germplasm under varying environmental conditions of Navsari, Paria and Waghai of south Gujarat would help their cultivation in different climatic regions. Consumer preference is needed for the distribution and popularity of any variety. The organoleptic test reported many positive attributes of NSP-7, such as its varied look, flavour, fibrousness, sweetness and texture which have made it appealing to a wide range of individuals, indicating its appropriateness for growth. Similar results were also reported in the past for the organoleptic evaluation of sweet potatoes by Malshe (2014) and Mohanta et al., (2016). The lowest incidence of weevil damage was noted in NSP-7, which has an excellent yield and relatively low sweet potato weevil damage percentage. Malshe (2014), Mohanta et al., (2016) and Hejjegar et al., (2023) also discovered results along these lines. NSP-7 have green with purple spots as vine pigmentation, immature leaf colour is mostly purple while mature leaf is green in colour. The flesh colour of tuber is also pale yellow or cream. It was found unique and different from other genotypes in this regard. In DNA finger printing analysis, NSP-7 was found genetically distinct.

Conclusion

The sweet potato genotype NSP-7 is a promising and high yielding genotype, which was also resistant to the sweet potato weevil also. It is liked by farmers, consumers and the food processing sector due to its good cooking quality and tuber quality attributes. Based on quality parameters and yield performance over the years and location, the NSP-7 genotype can be recommended for cultivation in the south Gujarat region for maximum economic or monetary gains.

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