

A High Yielding Anthocyanin Rich Brinjal Variety GNRB-1

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ABSTRACT: Plant breeding plays an important role for future vegetable production. The growing human population is outstripping vegetable production. Further, the climate change is adversely affecting crop growth and development. To cope with the growing human population and climate change, there is a need to improve the productivity and stability of vegetable crops by developing high yielding and good quality vegetable varieties. Vegetable crop improvement programme in India have concentrated on development of improved varieties with high yield, nutritive values along with abiotic and biotic stress resistance for cultivation at various locations across the country. A high yielding brinjal variety facilitates in improving the productivity, profitability and sustainability of brinjal cultivation in India. Department of Vegetable Science, ASPEE College of Horticulture has developed a high yielding, anthocyanin rich brinjal variety for cultivation in North-West Zone of India. GNRB-1 was evaluated at various locations around the country with four other entries and was compared with the standard check variety Swarna Mani. GNRB-1(393.67 q/ha) has recorded yield improvement of 16.86 % over national check Swarna Mani (336.89 q/ha) under Zone-I condition. It endows with special attributes viz., round, dark purple fruits which is rich in anthocyanin (475.3 mg/100g) and crude fibre (1.42%), and also contains total Phenol (2.07%), TSS (3.09 %), Vitamin C (2.90 mg/100g), β - carotene (0.77 mg/100g) and Glycoalkaloids (0.16%). This variety has recorded lesser incidence of little leaf disease, has less number of whitefly and jassid population *per* leaf. GNRB-1 was unidentified for notification by the Varietal Release Committee of AICRP (Vegetable Crops) held during 2020 and was notified for release by the Central Committee on Crop Standards, Notification and Release of Varieties for Agricultural Crops, vide the Gazette of India notification No. S.O. 3254 (E) dated 20th July, 2022.

Keywords: Brinjal, GNRB-1, Anthocyanin, Yield and Quality.

INTRODUCTION

Brinjal (*Solanum melongena* L.) is an agronomically important, widely consumed nutritious vegetable crop of Indian origin and has been cultivated in India for last 4,000 years (Sharma *et al.*, 2013). It is considered as rich source of vitamins and minerals. In ayurveda, it has been used as medicine to cure diabetes, liver diseases and serum cholesterol. Phenolic compounds present in brinjal are responsible for various bioactive properties of brinjal. Chlorogenic acid in the fruit flesh and anthocyanins in the fruit skin, have multiple properties beneficial for human health (Braga *et al.*, 2016). Brinjal is grown in almost all parts of the country. It has great genetic wealth in India, which is a foundation for crop improvement. The wide regional variations for plant,

flower and fruit descriptions revealed enough scope for improvement of yield characters by selection. Moreover, natural intercrossing, domestication, mutation, human selection and hybridization brought extensive genetic diversity of eggplant cultivars grown all over the world. Varietal differences concern mainly the shape, colour and size of fruits but the characters like, chemical composition, earliness, environmental requirements *etc.*, are also taken into consideration. Conventional breeding approaches are commonly used for improvement of yield, quality and resistance to insect-pests and diseases. Breeding of new brinjal varieties and improvement of growing technology results in the increase of both cultivation acreage and consumption scale.

MATERIAL AND METHODS

The brinjal variety GNRB-1 is a pureline developed through the brinjal accessions collected from the Dang District of Gujarat. During *Rabi* seasons of 2012-13 to 2015-16, it was evaluated in 13 state trials conducted at various locations across Gujarat in a randomized block design with three replications. It was also evaluated under All-India Co-ordinated Varietal Trial under IET during 2016-17 and further has been promoted in AVT-I during 2017-18 and evaluated in AVT-II during 2018-19. Each genotype consists of three rows with a spacing of 90 x 60 cm and the crop was raised as per package of practices. The recommended agronomical practices were followed and crop was maintained properly till last harvest. The observation on growth, yield as well as its contributing characters was noted on five randomly selected plants in each plot at different stages of crop growth. The data along with the pest and disease reactions and agronomic performance was utilized to identify the best performing genotype. The variety was characterized with 34 morphological characters based on DUS testing norms. Molecular profiling of GNRB-1 was performed along with standard checks viz., GJB-3 and GOB-1 using ISSR primer.

RESULTS AND DISCUSSION

The genotype GNRB-1 was evaluated under All-India Co-ordinated Varietal trial and state trials at various 26 locations around the country and at various 13 locations across Gujarat. The entries under experiment were evaluated for fruit yield and yield attributing characters, quality parameters viz., Total Phenol, TSS, Vitamin C, Anthocyanin, β -carotene, Crude fibre and Glycoalkaloids as well as for major pests and diseases reaction including general agronomical performance.

Fruit yield and yield attributes: The fruit yield and its contributing characters viz., fruit diameter, fruit length, average fruit weight and number of fruit per plant were studied for all the tested entries, including the standard check Swarna Mani (Table 1). GNRB-1 was found superior among all the tested entries along with check with a yield of 393.67 q/ha with yield increment of 16.86 % over the standard check Swarna Mani (336.89 q/ha). It was also evaluated in 13 state trials conducted at various locations across Gujarat during *Rabi* seasons

of 2012-13 to 2015-16 and recorded 308.6 q/ha productivity with 22.6 % and 18.0 % increased fruit yield over standard checks viz; GJB - 3 (251.6 q/ha) and GOB-1 (261.5 q/ha), respectively. The yield contributing characters like, fruit diameter (5.47 cm), average fruit weight (79.00 g) and number of fruit per plant (23.7) were higher in the variety GNRB-1 compared to the other tested entries and standards.

Quality parameters: The total phenol, TSS, anthocyanin and glycoalkaloids, etc., are important while considering the quality parameters in brinjal. These characters were measured at 5th harvest of brinjal fruits for comparison among the tested entries. GNRB-1 contains Total Phenol (2.07%), TSS (3.09%), Anthocyanin (475.3 mg/100g) and Glycoalkaloids (0.162%) (Table-3). It recorded 475.3 mg/100g Anthocyanin content which is higher than both the checks GJB -3 (390.1 mg/100g) and GOB-1 (419.9 mg/100g) while, it recorded low glycoalkaloids content (0.162 %) than both the check GJB-3 (0.175%) and GOB-1(0.173%). This confirmed that deep purple colour appearance of GNRB-1 fruit is due to the presence of high anthocyanins concentration in the peel which is in accordance with (Sadilova *et al.*, 2006). Anthocyanins are naturally synthesizing pigment which is present in peel and in flesh in minute quantity. Jhang *et al.* (2010) reported that peel tissue of brinjal had higher amount of anthocyanins than pulp tissue.

The phenol content is associated with antioxidant capacity as well as resistance against disease and pest in various crops (Mori *et al.*, 2017). Various studies have also reported a good correlation between the total phenol content of plant extracts and antioxidant activity (Kandolia *et al.*, 2015). The fruits of genotype are round, dark purple in colour, flowers have purple petals, leaves are purple green with purple veins, calyx is medium in size, spineless and purple in colour (Table-4).

Reaction to pests and diseases: Most important feature of proposed variety is, it has lesser incidence of little leaf disease, has less number of whitefly and jassid population *per* leaf compare to standard checks GJB-3 and GOB-1.

Table 1: Performance of GNRB-1 for fruit yield and yield contributing characters in zonal varietal trials.

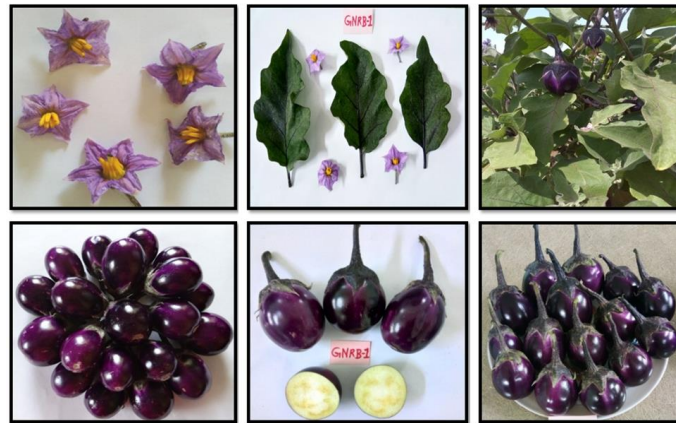
Variety	Fruit Yield (t/ha)	No. of fruit/plant	Fruit length (cm)	Fruit diameter (cm)	Fruit weight (g)	Days to first picking	Plant height (cm)	No. of primary branches
GNRB-1	393.67	23.70	6.57	5.47	70.00	63.00	92.40	5.90
Standard								
S. Mani	336.89	19.37	9.47	5.22	64.45	69.66	98.40	4.67

Table 2: Performance of GNRB-1 for fruit yield and yield contributing characters in state varietal trials.

Variety	Fruit Yield (t/ha)	No. of fruit/plant	Fruit length (cm)	Fruit girth (cm)	Fruit weight (g)	Days to first picking	Plant height (cm)	No. of primary branches
GNRB-1	308.60	23.70	7.40	17.70	79.00	75.70	77.00	5.90
Standards								
GJB-3	251.60	17.30	7.60	16.50	95.50	82.70	79.20	6.20
GOB-1	261.50	13.00	8.70	18.70	100.00	73.00	68.80	5.60

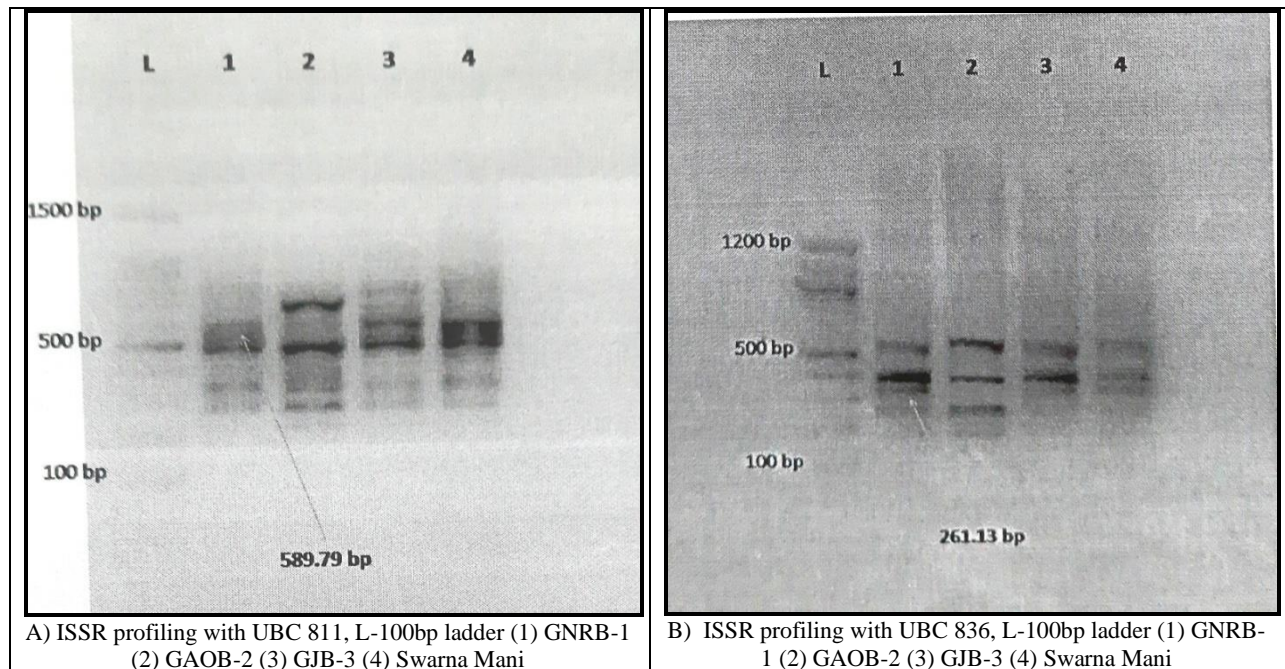
Table 3: Performance of GNRB-1 for quality attributes in state varietal trials.

Variety	Glycoalkaloids (%)	Total Phenol (%)	Anthocyanin (mg/100g)	Total soluble sugar (%)
GNRB-1	0.162	2.07	475.3	3.09
Standards				
GJB-3	0.175	2.11	390.1	3.00
GOB-1	0.173	2.19	419.9	2.88



(Plant growth habit, fruit colour and shape, leaf shape and flower colour)

Fig. 1. Morphological features of anthocyanin rich variety GNRB-1.



A) ISSR profiling with UBC 811, L-100bp ladder (1) GNRB-1 (2) GAOB-2 (3) GJB-3 (4) Swarna Mani

B) ISSR profiling with UBC 836, L-100bp ladder (1) GNRB-1 (2) GAOB-2 (3) GJB-3 (4) Swarna Mani

Fig. 2. DNA fingerprint profiles of GNRB-1 along with checks GAOB-2 (SC), GJB-3 (SC) and Swarna Mani (NC) as generated by the ISSR markers.

Table 4: DUS characteristics of brinjal variety ‘GNRB-1’.

Sr. No.	Traits	(GNRB-1)
1.	Seedling: Anthocyanin colouration of hypocotyls	Present
2.	Stem: Anthocyanin colouration	Present
3.	Stem : Pubescence	Medium
4.	Leaf : Length	Medium
5.	Leaf : Width	Medium
6.	Leaf : Margin	Sinuate
7.	Leaf : Blistering	Absent
8.	Leaf : Spininess	Absent
9.	Leaf : Blade colour	Dark purplish green
10.	Leaf : Intensity of colour of blade	Dark
11.	Leaf : Colour of vein	Purple
12.	Leaf : Intensity of colour of vein	Dark
13.	Inflorescence :Number of flowers	1 to 3
14.	Flower : Size	Medium
15.	Flower : Colour	Dark purple
16.	Fruit: General Shape	Round
17.	Fruit: Diameter of pistil scar	Medium
18.	Fruit: Shape of apex	Round
19.	Fruit: Colour of skin at commercial harvesting	Dark purple
20.	Fruit: Intensity of purple colour of skin	Dark
21.	Fruit: stripes	Absent
22.	Fruit: Patches	Absent
23.	Fruit: Glossiness at marketable stage	Strong
24.	Fruit: Size of calyx	Medium
25.	Fruit: Colour of calyx	Dark purple
26.	Fruit: Intensity of colour of calyx	Strong
27.	Fruit: Spininess of calyx	Absent
28.	Fruit: Rib	Absent
29.	Fruit: Colour of flesh	Whitish
30.	Fruit: Length of pedicel	Medium
31.	Fruiting: Pattern	Solitary
32.	Plant: Growth habit	Semi Spreading
33.	Plant: Spread (distance between two extremes leaf tips at widest point)	Medium
34.	Fruit: Colour of skin at marketable stage	Dark Purple

Distinguishing characteristics and molecular profiling: The important traits of this genotype are presented in Table 4 based on DUS testing norms. Several important morphological characters are presented in Fig.1. The molecular profiles were produced using two ISSR markers (Fig. 2) which gave distinct banding patterns for this variety.

The most distinguishing traits of the variety are:

- Fruits are round, dark purple in colour
- Presence of anthocyanin on stem and young leaves
- Leaves are purple green with purple veins
- Flowers are medium in size with purple petals
- Calyx is medium size and purple in colour

By virtue of its high and stable yield and quality performance all over locations of AICRP trials, the variety GNRB-1 was concluded to be the best suitable variety for cultivation in Gujarat, Jammu and Kashmir, Uttarakhand and Himachal Pradesh.

A national identity number, IC 620842 was allotted to the variety GNRB-1 by NBPGR, New Delhi. The variety was notified for release by the Central Committee on Crop Standards, Notification and Release of Varieties for Agricultural Crops, vide the Gazette of India notification SO 3254 (E) dated 20th July, 2022.

RECOMMENDATION

GNRB-1 is a high yielding, anthocyanin rich variety which is suitable for cultivation in *Kharif* and *Rabi* season, at 90 cm row spacing under normal environmental, irrigated condition in North West Zone of India. It required 400-500 g seeds for planting one hectare area. Its high yield and better quality will play a significant role in improving the productivity, profitability and sustainability of brinjal cultivation in North-West Zone of India.

FUTURE SCOPE

In future, this variety can be exploited commercially to increase quality production of brinjal and can also be used as a parent in hybridization.

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Conflict of Interest. None

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