

## Evaluation of F<sub>1</sub> crosses of brinjal (*Solanum melongena* L.) landraces for fruit yield, quality and tolerance to bacterial wilt

### Abstract

Field experiment was carried out at All India Coordinated Research Project on Vegetable Crops, OUAT, Bhubaneswar, Odisha, India in order to identify the superior F<sub>1</sub> crosses for marketable fruit yield quality and resistance to bacterial wilt. All total 21 F<sub>1</sub> crosses evolved from seven distinctly diverse local landraces of brinjal along with a hybrid check, Mahy Green were evaluated by adopting Randomized Block Design and replicated twice in *rabi* 2021-2022. Results revealed significant variations among various fruit quality attributes (TSS: 4.32 °Brix to 6.00 °Brix and ascorbic acid content of fruit: 5.10 mg100g<sup>-1</sup> to 7.10 mg100g<sup>-1</sup>), incidence of bacterial wilt (30 DAT:0.00% to 4.17%, 60 DAT: 0.00% to 12.50% and 90 DAT: 0.00% to 20.83%). Out of 21 crosses, nine cross showed immune reaction to bacterial wilt at 90 DAT. The marketable fruit yield plant<sup>-1</sup> varied significantly from 1.00 kg to 1.99 kg. The F<sub>1</sub> cross *viz.* BBSR-08-2 × Selection from BBSR-145-1 (1.99 kg) recorded significantly highest fruit yield plant<sup>-1</sup> followed by BBSR-08-2 × BBSR-10-25 (1.87 kg) and BBSR-08-2 × BBSR-10-26 (1.81 kg). Thus, it may be concluded that, F<sub>1</sub> crosses obtained from local landraces of brinjal *viz.*, BBSR-08-2 × Selection from BBSR-145-1, BBSR-08-2 × BBSR-10-25 and BBSR-08-2 × BBSR-10-26 may be recommended for higher marketable fruit yield, fruit quality and over all resistance to bacterial wilt for higher profit. These local landraces may also be used for future brinjal improvement programme towards development varieties with higher fruit yield quality and resistance to bacterial wilt.

**Key words:** Brinjal, F<sub>1</sub> crosses, fruit quality, bacterial wilt

### Introduction

Brinjal or eggplant (*Solanum melongena* L. 2n=24) is one of the most cultivated solanaceous fruit vegetable, cultivated predominantly in tropical and sub tropical regions of the world [1]. It is a flexible crop adapted to different agro-climatic regions and can be grown throughout the year. It is an important crop in the tropical regions of world and is being grown commonly in India, China, Turkey, Japan, Italy, Indonesia, Iraq, Syria, Spain and Phillipines [2]. Its immature fruits are generally used as vegetable and other culinary preparations, unripe fruit is essentially consumed as cooked vegetable in various forms and the dried shoots are used as firewood in rural areas. Brinjal is consumed by many ways like salad, bhaji, stuffed brinjal, bharta, pickles etc., has make the brinjal is more popular vegetables in India. Its fruits are widely consumed in various culinary preparations and are rich source of protective nutrients [3]. Brinjal fruits are rich source of minerals like calcium, phosphorus and magnesium along with fatty acids [4]. Brinjal fruits are also known for its medicinal properties in curing diabetic, asthma, cholera, bronchitis, diarrhea, blood cholesterol [5].

**Comment [A1]:** It may be better for the conclusion not to be put in the abstract, but after the results or before the references

Although brinjal is cultivated in different parts of India, but the productivity low as the area is majorly covered by 50.0% of OP/HYV and 32.2% of local types against 17.8 % of hybrids [6]. In India, Odisha stands second in brinjal production with share of 16.34% [7]. Odisha being a major producer, the productivity in the state is very low primarily due to prevalence of local landraces which possess low yield potential but greater resistance towards biotic and abiotic stresses along with better fruit quality.

The brinjal cultivation in the state is acutely affected by various biotic and abiotic stresses. Among the biotic stress, bacterial wilt is the most devastating disease in solanaceous vegetable grown in India including Odisha [8]. In brinjal, the disease limits its production from 4.24 to 86.14 per cent Sabita et al. [9] while in hot and humid climate, it can cause up to as high as 100% losses [10]. Recently, this disease has risen to alarming proportion in the plains of India including in state of Odisha due to its severity.

Therefore, there is urgency in brinjal crop improvement programme by proper utilization of local landraces through adoption of appropriate breeding method. In other hand there is a need to exploit heterosis for fruit yield quality attributes of local landraces and to incorporate the bacterial wilt resistance or tolerance with wider adaptability in developed varieties. Keeping these facts in view, the present investigation was carried out for identification of F<sub>1</sub> crosses of local landraces of brinjal for fruit yield, quality and tolerance to bacterial wilt.

#### **Materials and Methods**

The present experiment was conducted at All India Coordinated Research Project on Vegetable Crops, OUAT Bhubaneswar, Odisha during *rabi* 2021-2022. Six distinctly divergent local landraces of brinjal *viz.*, BBSR-08-02, BBSR-10-25, BBSR-10-26, BBSR-9-6, BSR-195-3 and Selection from BBSR-145-1 and one bacterial wilt susceptible variety, Arka Neelanchal Shyama (ANS) were used in the hybridization programme. The resultant 21 F<sub>1</sub> crosses evolved through half diallel mating (excluding the reciprocals) along with seven parents and one hybrid check Mahy Green of Mahyco Private Limited, India were evaluated by adopting RBD and replicated twice for fruit yield and fruit quality and reaction to bacterial wilt disease in *rabi* 2021-2022. Recommended package of practices were adopted uniformly for raising of the crops. Observations were recorded for fruit yield, fruit quality and percentage of incidence of bacterial wilt at 30 days after transplanting(DAT), 60 DAT and 90 DAT. TSS was determined by digital refractometer and expressed in °Brix. The ascorbic acid content of brinjal fruit samples were calculated using the volumetric technique [11]. Wilting percentage at was calculated as per following the formula [12]:

$$W\% = (Nw/Nt) \times 100,$$

Where,

Nw = number of wilted plants

Nt = total number of plants

The individual germplasm was categorized 0-5 scale based on the PDI value [13].

**Comment [A2]:** Add cultivation

**Comment [A3]:** the advantages and disadvantages of each individual can be added

Scale	Wilting % (PDI)	Disease Reaction
0	No symptoms	Immune
1	1.00 to 20.00	Highly resistant / HR
2	21.00 to 40.00	Moderately resistant/ MR
3	41.00 to 60.00	Moderately susceptible/ MS
4	61.00 to 80.00	Susceptible/ S
5	> 80.00	Highly susceptible/ HS

All the observed data were subjected to statistical analysis [14].

**Comment [A4]:** Better explain what statistical analysis is used

## Results and Discussion

### Incidence of bacterial wilt

Bacterial wilt in brinjal is caused by soil-borne pathogen, *Ralstonia solanacearum* (Smith) which belongs to the family  $\beta$ -proteobacteria, non-spore forming, gram negative and rod shaped bacterium. The wilt infection is characterized by sudden wilting of the foliage followed by collapse of the entire plant. The wilting symptoms include dropping and yellowing of leaves, vascular discoloration [15] and stunted plant growth. Drying of the plants at the time of flowering and fruiting are also the symptoms of wilt. A white milky stream of bacterial oozes comes out when the infected cut stem dipped in water is used as the diagnostic symptom for bacterial wilt [16]. The cultural and chemical disease management methods such as soil fumigation, crop rotation, adjustment of planting date and application of chemicals are limited due to its broad distribution, vascular nature, wide host range, great variability and ability to survive in soil and water [17].

In brinjal incidence of bacterial wilt is a serious problems in many part of world including India. It has been reported that yield loss ranges from 10 to 100% in hot and humid tropical areas with acidic soil [9, 18]. Hence, development of new F<sub>1</sub> cross(es) with resistant or tolerance to bacterial wilt definitely increase yield potential of genotype.

The data recorded on bacterial wilt incidence at 30 DAT and 60 DAT (Table-1) revealed that, the incidence of bacterial wilt (%) varied from 0.00 to 4.17 and 0.00 to 12.50, respectively. At 30 DAT, all the F<sub>1</sub> crosses exhibited 0.00 or immune reaction to bacterial wilt except BBSR-09-6  $\times$  ANS and BBSR-195-3  $\times$  ANS (4.17). However, at 60DAT maximum disease incidence was recorded due to transition from vegetative phase to reproductive phase. At 60 DAT, out of 21 F<sub>1</sub> crosses, 11 crosses exhibited immune reaction to bacterial wilt. Similar reports on peak of bacterial wilt incidence in brinjal was also observed by Antony et al.[19].

In the present study, the result showed significant variations towards bacterial wilt at 90 DAT ranging from 0.00 to 20.83 under sick plot conditions. Among the F<sub>1</sub> crosses, the crosses viz. BBSR-08-2  $\times$  BBSR-10-25, BBSR-08-2  $\times$  BBSR-10-26, BBSR-08-2  $\times$  BBSR-09-6, BBSR-08-2  $\times$  BBSR-195-3, BBSR-10-25  $\times$  BBSR-10-26, BBSR-10-25  $\times$  BBSR-09-6,

BBSR-10-26 × BBSR-195-3, BBSR-10-26 × Selection from BBSR-145-1 and BBSR-195-3 × Selection from BBSR-145-1 showed immune reaction to bacterial wilt, which may be used as parent in future stress breeding programme. Bhubaneswar, Odisha is considered as one of the hot spots for bacterial wilt disease mainly due to hot and humid climate and acidic soil [20], so genotype exhibiting immune reaction under this condition will definitely show resistance or tolerance bacterial wilt disease in other location of country.. Similar results were also confirmed by Tripathy et al. [21] under Bhubaneswar conditions. Many of the F<sub>1</sub> crosses showed highly resistance (0.00%) to bacterial wilt because, the cross involving one of the resistant parent contributed to impact high resistance to the disease which was also earlier reported by Khapte et al.[22] and Barik et al.[23] in brinjal. In the F<sub>1</sub> crosses BBSR-195-3 × Selection from BBSR-145-1, the resistance to bacterial wilt might be due to initial suppression of wilt at the time of observation due to requirement of longer incubation period. Similar report was also reported by Gopalkrishnan et al. [13]. The local landraces, BBSR-08-2, BBSR-10-25 and BBSR-10-26 were also reported as immune to bacterial wilt under sick plot of AICRP vegetable crops, OUAT, Bhubaneswar [21].

### **Fruit yield**

Yield being a complex character affected by various biotic and abiotic factors. In the present investigation, marketable fruit yield refers to the quantity of salable fruit produced excluding the small and borer infested fruits, rotten fruits etc. From economic cultivation of brinjal point of view, the producer always interested to grow resistant/ tolerant variety(ies) with higher marketable fruit yield, as only marketable fruit yield will enhance both productivity and profitability. A perusal of data presented in the Table-1 revealed significant variations for marketable fruit yield plant<sup>-1</sup>. The marketable yield plant<sup>-1</sup>(kg) varied from 1.00 (BBSR-10-25 × Selection from BBSR-145-1) to 1.99 (BBSR-08-2 × Selection from BBSR-145-1) with a grand mean value of 1.41. Significantly highest fruit yield plant<sup>-1</sup> (1.99 kg) was recorded by F<sub>1</sub> cross, BBSR-08-2 × Selection from BBSR-145-1 than the rest of the F<sub>1</sub> crosses except BBSR-08-2 × BBSR-10-25 (1.87) where *statistical parity* was observed. Out of 21 F<sub>1</sub> crosses, eight crosses *viz.*, BBSR-08-2 × BBSR-10-25, BBSR-08-2 × BBSR-10-26, BBSR-08-2 × BBSR-09-6, BBSR-08-2 × BBSR-195-3, BBSR-08-2 × Selection from BBSR-145-1, BBSR-10-25 × BBSR-195-3, BBSR-10-26 × BBSR-195-3 and BBSR-10-26 × Selection from BBSR-145-1 exhibited higher fruit yield plant<sup>-1</sup> than the check, Mahy Green (1.41 kg). Similarly, the unmarketable yield plant<sup>-1</sup> (kg) was highest in BBSR-09-6 × BBSR-195-3 (0.20) as that of minimum in BBSR-08-2 × Selection from BBSR-145-1 and BBSR-08-2 × BBSR-10-26 (0.10). Maurya and Yadav [2] also reported the marketable fruit yield plant<sup>-1</sup> in brinjal F<sub>1</sub> crosses ranging from 0.97 kg to 2.13 kg. The results are in agreement with the findings of Nirmala et al.[24] and Bajpai et al.[25].

### **Fruit quality attributes**

TSS (Total Soluble Solids) value affects the taste of the fruit, because it can indicate the level of sweetness of the fruit. TSS is dominated by total sugar content and a small portion of soluble proteins, amino acids and other organic materials [26]. Higher TSS gives the good fruit taste, and consumer preference will be more for such fruits [27]. Observations

recorded on TSS revealed significant variations (Table-2). The TSS (<sup>0</sup>Brix) content of fruit varied from 4.32 (BBSR-195-3 × Selection from BBSR-145-1) to 6.00 (BBSR-08-2 × BBSR-10-26). The maximum TSS content was recorded by the cross BBSR-08-2 × BBSR-10-26 followed by BBSR-08-2 × BBSR-10-25 (5.50), BBSR-08-2 × ANS and BBSR-10-26 × Selection from BBSR-145-1 (5.35). Similar observations on TSS of brinjal fruit have been reported by Tripathy et al. [28] and Koundinya et al. [29] ranging from 3.50 to 4.80 and 4.00 to 6.8, respectively.

Generally, the higher ascorbic acid content would increase the nutritive value of the fruits, which would help better retention of colour and flavor [30]. Similarly, the ascorbic acid content of fruits (mg100g<sup>-1</sup>) varied from 5.10 (BBSR-09-6 × Selection from BBSR-145-1) to 7.10 (BBSR-10-26 × BBSR-195-3). The maximum ascorbic acid content was recorded by BBSR-10-26 × BBSR-195-3 closely followed by BBSR-08-2 × BBSR-195-3 (6.73) and BBSR-08-2 × ANS (6.71) where *statistical parity* was observed. Kadivec et al. [31] also reported wide variation for ascorbic acid content in brinjal ranging from 3.36 to 9.27 in brinjal.

Thus it may be concluded from the present study that, out of 21 F<sub>1</sub> crosses obtained from local landraces of Odisha brinjal, the F<sub>1</sub> crosses *viz.*, BBSR-08-2 × BBSR-10-25, BBSR-08-2 × Selection from BBSR-145-1 and BBSR-08-2 × BBSR-10-26 may be recommended for commercial cultivation not only due to resistance to bacterial wilt but also significantly higher marketable fruit yield with relatively superior fruit quality attributes. These local landraces may also be used for future brinjal improvement programme towards development varieties with higher fruit yield quality and resistance to bacterial wilt.

## Conclusion

Comment [A5]: Add it

## References

1. Taher D, Solberg SØ, Prohens J, Chou Y, Rakha M and Wu T.. World vegetable center eggplant collection: origin, composition, seed dissemination and utilization in breeding. *Front Plant Sci.* 2017; 8: 1484.
2. Maurya VK and Yadav GC. Evaluation of the performance of parental line and their F<sub>1</sub> hybrids for yield and quality traits in brinjal (*Solanum melongena* L.), *Int J Plant Soil Science.* 2022; 34(20): 2320-7035.
3. Hedges LJ and Lister CE. Nutritional attributes of spinach, silver beet and eggplant. *Crop and Food Research Confidential, Report No.* 1928; 2007.
4. Afful NT, Nyadanu D, Akromah R, Amoatey HM, Annor C and Diawouh RG. Nutritional and antioxidant composition of eggplant accessions in Ghana. *AfrCrop Sci J.* 2019; 27(2):193-211.
5. Sabolu S, Kathiria KB, Mistry CR and Kumar S. Generation mean analysis of fruit quality traits in eggplant (*Solanum melongena* L.). *Aus J Crop Sci.* 2014; 8(2): 243.

6. Tripathy B, Tripathy P, Sahu GS, Dash SK, Pradhan B, Sahu P, Nayak NJ, Pradhan P, Sourav S and Mishra S. Evaluation of brinjal (*Solanum melongena* L.) local landraces of Odisha for fruit yield and its components. *J Crop and Weed*. 2020; 16(1): 151-154.
7. Area and production of Horticultural crops, 3<sup>rd</sup> advance estimate 2021-2022, Department of Agriculture and Farmers Welfare, Government of India
8. Biswal G and Dhal NK. Management of bacterial wilt disease of potato in coastal plains of Odisha. *Afr J Microbiol and Res*. 2018; 12(12): 284-289.
9. Sabita JN, Boruah BM and Rachid HA.. Yield potentiality of some brinjal cultivars in severely bacterial wilt infected condition. *Veg Sci*, 2000; 27: 76-77.
10. Bainsla NK, Singh S, Singh P K, Kumar K, Singh AK and Gautam RK. Genetic behavior of bacterial wilt resistance in brinjal (*Solanum melongena* L.) in tropics of Andaman and Nicobar Island of India. *Am J Plant Sci*. 2016; 7: 333-338.
11. Sadasivam S and Balasubramanian T. Practical manual in biochemistry. Tamil Nadu Agricultural University, Coimbatore, India. 1987;14.
12. Namisy A, Chen J, Prohens J, Metwally E, Elmahrouk M and Rekha M. Screening cultivated eggplant and wild relatives for resistance to bacterial wilt (*Ralstonia solanacearum*). *Agric*. 2019; 9(157).
13. Gopalakrishnan C, Singh TH and Artal RB. Evaluation of eggplant accessions for resistance to bacterial wilt caused by *Ralstonia solanacearum* (E.F. Smith). *J of Hort Sci*. 2014; 9: 202–205.
14. Gomez KA. and Gomez AA. Statistical Procedures for Agricultural Research, 2<sup>nd</sup>ed., John Wiley and Sons, New York. 1983.
15. Rai PV, Shivappasetty KKA and Vasanthasetty KP. Bacterial wilt of petunia and its source of inoculum. *Curr Res*, 1975; 4:173–174.
16. Ramesh R. Bacterial wilt in brinjal and its management. Technical bulletin10, ICAR RC For Goa. 2008.
17. Pandiyaraj P, Singh TH, Reddy KM, Sadashiva AT, Gopalakrishnan C, Reddy AC, Pattanaik A, & Reddy ADCL. Molecular markers linked to bacterial wilt (*Ralstonia solanacearum*) resistance gene loci in eggplant (*Solanum melongena* L.). *Crop Prot*, 2019: 124
18. Nishat S, Hamim I and Ibrahim KM. Genetic diversity of the bacterial wilt pathogen *Ralstonia solanacearum* using a RAPD marker. *C R Biol*. 2015; 338: 757-67.
19. Antony RS, Gopaldasamy G and Senthilkumar M. First report of bacterial wilt caused by *Ralstonia solanacearum* Race I Biovar I in eggplant (*Solanum melongena*) in Tamil Nadu, Southern India. *Plant Disease*. 2015; 99(9): 1271.
20. Sarkar S and Chaudhuri S. Bacterial wilt and its management. *Curr Sci*, 2016; 1439-1445.
21. Tripathy B, Tripathy P, Sahu GS, Dash SK, Pradhan BD, Lenka D and Das S.. *Per Se* performances of brinjal (*Solanum melongena* L.) F<sub>1</sub> crosses for fruit yield and bacterial wilt tolerance. *Pharma Innovation*.2021; 10(10): 490-494.
22. Khapte PS, Singh TH and Reddy DCL. Screening of elite eggplant (*Solanum melongena*) genotypes for bacterial wilt (*Ralstonia solanacearum*) in field conditions

- and their genetic association by using SSR markers. Ind J of Agric Sci. 2018; 88(10): 22-29.
23. Barik S, Ponnam N, Acharya GC, Sandeep V, Singh TH, Kumari M, Srinivas P and Sahu GS. Genetic analysis of bacterial wilt resistance in eggplant (*Solanum melongena* L.). Eur J of Plant Pathol. 2021; 160: 349-364.
  24. Nirmala N, Praneetha S and Manivannan N. 2013. *Per se* performance of cluster bearing, glossy purple Brinjal (*Solanum melongena* L.) hybrids for economic traits. Electron J of Plant Breed. 2013; 4(2): 1188-1192.
  25. Bajpai RK, Mishra DP, Yadav GC, Kumar V and Kumar S. Evaluation of F<sub>1</sub> hybrids and parental lines for quantitative and qualitative traits of brinjal. Int J of Chem Stud. 2020; 8(5): 768-773.
  26. Hadiwijaya Y, Putri IE, Mubarak S, Hamdani JS. Rapid and non-destructive prediction of total soluble solids of guava fruits at various storage periods using handheld near-infrared instrument. In IOP Conference Series: Earth and Environ. Sci. 2020; 458(1):12-22.
  27. Naveen YKV, Patel AI, Joshi RJ, Chhodavadiya RJ, Moharana SK and Sojitra AM. Genetic studies on fruit yield and its componenets in brinjal (*Solanum melongena* L.). Pharama Innovation. 2022; 11(10): 1615-1620.
  28. Tripathy B, Sharma D, Jangde BP and bairwa PL. Evaluation of brinjal (*Solanum melongena* L.) genotypes for growth and yield characters under Chhattisgarh condition. Pharama Innovation. 2017; 6(10): 416-420.
  29. Koundinya AVV, Pandit MK, Dolui S, Bhattacharya A and Hegde V. Multivariate analysis of fruit quality traits in brinjal. Indian J Hort. 2019; 76 (1): 84-103.
  30. Sasikumar A. Screening of eggplant (*Solanum melongena* L.) genotypes for quality and yield. M.Sc., (Hort.) Thesis, Tamil Nadu Agricultural University, Coimbatore; 1999.
  31. Kadivec M, Kopjar M, Znidarcic D and Pozrl T. Potential of eggplant peel as by-product. Acta Aliment. 2015; 44(1): 126-131.

Table-1 ; Performance of F<sub>1</sub> crosses for bacterial wilt incidence, marketable fruit yield and unmarketable fruit yield

Sl No.		% BW incidence at 30 DAT	% BW incidence at 60 DAT	% BW incidence at 90 DAT	Marketable yield plant <sup>-1</sup> (kg)	Un marketable Yield plant <sup>-1</sup> (kg)
1	BBSR-08-2 × BBSR-10-25	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	1.87	0.11
2	BBSR-08-2 × BBSR-10-26	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	1.81	0.10
3	BBSR-08-2 × BBSR-09-6	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	1.75	0.13
4	BBSR-08-2 × BBSR-195-3	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	1.76	0.11
5	BBSR-08-2 × Selection from BBSR-145-1	0.00 (0.71)	0.00 (0.71)	4.17 (1.84)	1.99	0.10
6	BBSR-08-2 × Arka Neelanchal Shyama	0.00 (0.71)	8.33 (2.97)	12.50 (3.55)	1.39	0.13
7	BBSR-10-25 × BBSR-10-26	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	1.05	0.12
8	BBSR-10-25 × BBSR-09-6	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	1.29	0.11
9	BBSR-10-25 × BBSR-195-3	0.00 (0.71)	0.00 (0.71)	4.17 (1.84)	1.71	0.10
10	BBSR-10-25 × Selection from BBSR-145-1	0.00 (0.71)	4.17 (1.84)	8.33 (2.97)	1.00	0.13
11	BBSR-10-25 × Arka Neelanchal Shyama	0.00 (0.71)	8.33 (2.97)	12.50 (3.55)	1.19	0.13
12	BBSR-10-26 × BBSR-09-6	0.00 (0.71)	4.17 (1.84)	8.33 (2.97)	1.35	0.15
13	BBSR-10-26 × BBSR-195-3	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	1.77	0.12
14	BBSR-10-26 × Selection from BBSR-145-1	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	1.58	0.18
15	BBSR-10-26 × Arka Neelanchal Shyama	0.00 (0.71)	4.17 (1.84)	8.33 (2.97)	1.40	0.14
16	BBSR-09-6 × BBSR-195-3	0.00 (0.71)	8.33 (2.97)	12.50 (3.55)	1.33	0.20
17	BBSR-09-6 × Selection from BBSR-145-1	0.00 (0.71)	4.17 (1.84)	8.33 (2.97)	1.31	0.14
18	BBSR-09-6 × Arka Neelanchal Shyama	4.17 (1.84)	8.33 (2.97)	12.50 (3.55)	1.34	0.15
19	BBSR-195-3 × Selection from BBSR-145-1	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	1.37	0.13
20	BBSR-195-3 × Arka Neelanchal Shyama	4.17 (1.84)	12.50 (3.55)	20.84 (4.60)	1.26	0.13
21	Selection from BBSR-145-1 × Arka Neelanchal Shyama	0.00 (0.71)	8.33 (2.97)	16.67 (4.14)	1.24	0.19
22	BBSR-08-2	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	1.15	0.11
23	BBSR-10-25	0.00 (0.71)	0.00 (0.71)	0.00(0.71)	1.06	0.11
24	BBSR-10-26	0.00 (0.71)	0.00 (0.71)	0.00(0.71)	1.36	0.12
25	BBSR-09-6	0.00 (0.71)	8.33 (2.97)	8.33 (2.97)	1.24	0.15
26	BBSR-195-3	0.00 (0.71)	4.17 (1.84)	4.17 (1.84)	1.57	0.14
27	Selection from BBSR-145-1	0.00 (0.71)	4.17 (1.84)	4.17 (1.84)	1.23	0.17
28	Arka Neelanchal Shyama	12.50 (3.55)	25.00 (5.05)	29.17 (5.43)	1.26	0.12
29	Mahy Green (Check)	0.00 (0.71)	4.17 (1.84)	12.50 (3.55)	1.41	0.15
	GM	0.72 (0.88)	4.02 (1.70)	6.46 (2.16)	1.41	0.13
	SE(m)±	0.32	0.58	0.51	0.06	0.01
	CD (P=05)	0.92	1.67	1.47	0.17	0.04
	CV %	50.46	47.92	33.07	5.82	14.26

\*Figures in parenthesis indicates the square root transformed values

Table-2 Performance of F<sub>1</sub> crosses for fruit quality attributes

Sl No.		TSS (°Brix)	Ascorbic acid content (mg100g <sup>-1</sup> )
1	BBSR-08-2 × BBSR-10-25	5.50	6.00
2	BBSR-08-2 × BBSR-10-26	6.00	6.21
3	BBSR-08-2 × BBSR-09-6	5.02	6.09
4	BBSR-08-2 × BBSR-195-3	5.19	6.73
5	BBSR-08-2 × Selection from BBSR-145-1	5.01	6.07
6	BBSR-08-2 × Arka Neelanchal Shyama	5.35	6.71
7	BBSR-10-25 × BBSR-10-26	5.24	6.09
8	BBSR-10-25 × BBSR-09-6	5.06	5.71
9	BBSR-10-25 × BBSR-195-3	5.15	5.92
10	BBSR-10-25 × Selection from BBSR-145-1	5.16	6.28
11	BBSR-10-25 × Arka Neelanchal Shyama	5.15	5.94
12	BBSR-10-26 × BBSR-09-6	5.09	6.13
13	BBSR-10-26 × BBSR-195-3	5.30	7.10
14	BBSR-10-26 × Selection from BBSR-145-1	5.35	5.68
15	BBSR-10-26 × Arka Neelanchal Shyama	4.92	5.88
16	BBSR-09-6 × BBSR-195-3	5.01	5.35
17	BBSR-09-6 × Selection from BBSR-145-1	5.14	5.10
18	BBSR-09-6 × Arka Neelanchal Shyama	4.98	5.96
19	BBSR-195-3 × Selection from BBSR-145-1	4.32	6.13
20	BBSR-195-3 × Arka Neelanchal Shyama	4.73	5.97
21	Selection from BBSR-145-1 × Arka Neelanchal Shyama	5.22	5.75
22	BBSR-08-2	4.43	5.40
23	BBSR-10-25	4.50	5.00
24	BBSR-10-26	4.29	5.23
25	BBSR-09-6	4.19	4.95
26	BBSR-195-3	4.29	5.01
27	Selection from BBSR-145-1	4.55	4.30
28	Arka Neelanchal Shyama	4.91	5.51
29	Mahy Green (Check)	4.51	5.13
	GM	4.95	5.77
	SE(m)±	0.17	0.25
	CD (P=05)	0.48	0.72
	CV %	4.74	6.10