Evaluation of F_1 crosses of brinjal (*Solanum melongena* L.) landraces for growth, flowering and fruit yield attributes

ABSTRACT

All total 21 F_1 crosses of local landraces were evaluated along with seven parents and one check of brinjal by adopting RBD replicated twice at AICRP on Vegetable Crops, OUAT, Bhubaneswar, Odisha. Results revealed significant variations among various vegetative characters (plant height : 74.50 cm to 110.90 cm, plant spread (EW): 72.75 cm to 89.55 cm and NS :70.00 cm to 91.25cm, primary branches plant^{-1}: 4.00 to 5.40), flowering parameters (days to 1st flowering:45.60 to 55.00 and 50% flowering: 55.00 to 66.40) and fruit yield attributes (fruit length:11.35 cm to 16.35 cm, fruit breadth :15.35 cm to 25.75 cm, fruit weight:118.40 g to 217.30g and fruits plant^{-1}: 11.80 to 17.70). The F_1 cross *viz.* BBSR-08-2 × Selection from BBSR-145-1(2.09 kg) recorded significantly highest fruit yield plant^{-1} followed by BBSR-08-2 × BBSR-10-25(1.98 kg) and BBSR-08-2 × BBSR-10-26 (1.91 kg). Thus, on the basis of *per se* performance, the F_1 crosses *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 commercial cultivation. The parent Arka Neelanchal Shyama may be used as a parent to develop early variety in brinjal.

Keywords: Brinjal, Local landraces, F_1 crosses, Performance

Introduction

Brinjal (*Solanum melongena* L., 2n= 2x = 24), commonly known as eggplant or aubergine, is one of the most important warm season fruit vegetable crop cultivated predominantly in tropical and sub tropical regions of the world [1]. Unripe fruit of brinjal is primarily consumed as cooked vegetable in various ways and dried shoots are used as fuel in rural areas. It is low in calories and fats, contains mostly water, some protein, fibre and carbohydrates. Brinjal fruits are rich source of minerals like calcium, phosphorus and magnesium along with fatty acids [2]. Brinjal fruits are also known for its medicinal properties in curing diabetic, asthma, cholera, bronchitis, diarrhea, blood cholesterol [3]. Brinjal is originated from India (Indo–Burma region) with secondary center of China and South East Asia [4, 5]. In India, it is one of the most common, popular and principal vegetable crops grown throughout the country except higher altitudes. It is a versatile crop adapted to different agro-climatic regions of the country and can be grown throughout the year. A number of cultivars are grown in India, but consumer preference is being dependent upon fruit color, size and shape and varied considerably with location. The major brinjal producing states in the country are West Bengal, Odisha, Gujarat, Bihar and Madhya Pradesh. Odisha stands second in brinjal production with share of 16.34% [6]. Odisha being a major producer of brinjal, 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. Existence of ample variability and diversity among these local landraces should be exploited for development of F_1

hybrids or high yielding varieties through systematic crop improvement programme with resistance or tolerance to major disease and pest. Another considerable influence of engaging local landraces favors evolution of new variety with shape, size and colour according to the local consumer preference. Keeping these facts in view, the present investigation was carried out for identification of F_1 crosses of local landraces of brinjal for growth, flowering, fruit yield and yield attributes.

Materials and Methods

The present investigation was carried out 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 were used in the hybridization programme. The resultant 21 F_1 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 vegetative, flowering, fruit yield and yield attributes. One month old seedlings were transplanted in the main field. Recommended package of practices were adopted uniformly for raising of the crops. Observations were recorded for vegetative traits, flowering and fruit yield and yield attributes. All the observed data were subjected to statistical analysis [7].

Results and Discussion

The results recorded on vegetative growth parameters revealed significant variations among t 21 F_1 crosses indicating the existence of variability among the tested F_1 crosses (Table-1). Plant height of brinjal recorded at final harvest stage showed significant variations ranging from 74.50 cm (Selection from BBSR-145-1 × Arka Neelanchal Shyama) to 110.90 cm (BBSR-08-2 × BBSR-10-25). The F_1 cross, BBSR-08-2 × BBSR-10-25 produced tallest plant of 110.90 cm than the rest of the tested F_1 cross, parents and check except BBSR-08-2 × BBSR-09-6 (107.25 cm) and BBSR-08-2 × BBSR-195-3 (105.85 cm), which was *statistically at par* with the highest value. Similarly, the plant spread recorded in both direction, East-West and North-South showed significant variations among the 21 tested F_1 crosses ranging from 72.75 cm (BBSR-10-26 × Selection from BBSR-145-1) to 89.55 cm (BBSR-09-6 × Selection from BBSR-145-1) and 70.00 cm (Selection from BBSR-145-1 × Arka Neelanchal Shyama) to 91.25 cm (BBSR-08-2 × BBSR-10-25), respectively. The result also showed that, invariably F_1 crosses recorded higher plant spread in both directions as compared to their parents indicating inheritance of traits from parent to progeny. Similar results of inheritance of plant spread have also been reported by Dash et al. [8].

In brinjal, the number of primary branches plant^{-1} plays very crucial role towards the total number of flowers which in terms produce higher number of fruits plant^{-1}. Therefore, it is essential to develop new genotype having higher number of primary branches plant^{-1}. In the present study, the result showed significant variations among 21 F_1 crosses as well as seven

parents which varied significantly from 4.00 (BBSR-09-6 ×BBSR-195-3) to 5.40 (BBSR-10-25 × Selection from BBSR-145-1) and 3.30 (Selection from BBSR-145-1) to 6.50 (Arka Neelanchal Shyama), respectively. Significantly higher number of primary branches plant^{-1} was recorded by BBSR-10-25 × Selection from BBSR-145-1(5.40) than rest of the crosses except BBSR-08-2 × BBSR-10-25(5.00), BBSR-08-2 × BBSR-195-3 (5.00), BBSR-08-2 × Selection from BBSR-145-1 (5.10) and Selection from BBSR-145-1 × Arka Neelanchal Shyama (4.90) which were *statistical at par* with the highest value. Similar variations among F_1 crosses over parents in brinjal were also reported by Dash et al. [8], Bajpai et al. [9] and Tripathy et al. [10].

Results on mean performance of F_1 crosses towards vegetative parameters *viz.* plant height at final harvest, plant spread (East-West and North-South) and number of primary branches plant^{-1} revealed that invariably the parent BBSR-08-2 as a female parent induced vigourness when crossed with other parent (Table-1) which ranging from 88.85 cm (BBSR-08-2 × Arka Neelanchal Shyama) to 110.90 cm (BBSR-08-2 × BBSR-10-25) for plant height, 73.30 cm (BBSR-08-2 × BBSR-10-26) to 89.45 cm (BBSR-08-2 × BBSR-10-25). For plant spread (East-West), 71.35 cm (BBSR-08-2 × Selection from BBSR-145-1) to 91.25 cm (BBSR-08-2 × BBSR-10-25) for plant spread (North- South) and 4.30 (BBSR-08-2 × BBSR-10-26) to 5.10 (BBSR-08-2 × Selection from BBSR-145-1) for primary branches plant^{-1} as against common parent BBSR-08-2 (92.40cm, 81.80cm, 77.05cm and 4.70, respectively. Thus the result clearly indicated superiority of parent BBSR-08-2 to induce vigourness in brinjal which may be used in future brinjal improvement programme. Complementary reports of significant disparity among the F_1 crosses and parents in brinjal for vegetative growth traits were proclaimed earlier by Sivakumar et al. [11], Vethamoni and Praneetha [12], Kumar et al. [13], Khobragade et al. [14] and Tripathy et al. [10].

In commercial cultivation of brinjal, earliness primarily depends upon early flowering in terms of days to 1st flower and days to 50 % flowering which will extend fruiting period in long duration crop. Results of present study (Table-1) showed significant variations among tested crosses for days to 1st flower and days to 50% flower ranging from 45.60 (BBSR-10-26 × Selection from BBSR-145-1) to 55.00 (BBSR-08-2 × BBSR-10-26) and 55.00 (BBSR-10-26 × Selection from BBSR-145-1) to 66.40 (BBSR-195-3 × Selection from BBSR-145-1), respectively. The result also showed that the F_1 cross *viz.* BBSR-10-26 × Selection from BBSR-145-1, BBSR-10-26 × Arka Neelanchal Shyama and Selection from BBSR-145-1 × Arka Neelanchal Shyama recorded slightly earliness to both days to 1st flower and days to 50% flowering. Similar result of significant variations in flowering habit among F_1 crosses with their parents in brinjal were also reported by Chinthagunti et al. [15], Khobragade et al. [14], Tripathy et al. [10] and Maurya and Yadav [16]. Invariably, the male parent, Arka Neelanchal Shyama induces earliness to days to 1st flower among the tested F_1 crosses which may be used in brinjal improvement programme. The results of present study are in confirming with the finding of Barik et al. [17] who have also reported thet Arka Neelanchal Shyama as early brinjal variety.

Significant variations among fruit yield and yield attributing traits were observed among the tested F_1 crosses (Table-2). Fruit length varied significantly among F_1 crosses from 11.35 cm (BBSR-09-6 × Arka Neelanchal Shyama) to 16.35 cm (BBSR-195-3 × Selection from BBSR-145-1). Similarly the F_1 cross BBSR-10-25 × BBSR-09-6 recorded lowest fruit breadth (15.35 cm), fruit weight (118.40) and fruits plant^{-1} (11.80) as against the maximum fruit breadth 25.75 cm (BBSR-08-2 × BBSR-195-3), fruit weight 217.30g (BBSR-195-3 × Selection from BBSR-145-1) and fruits plant^{-1} 17.70 (BBSR-10-25 × BBSR-195-3). The result also revealed F_1 crosses BBSR-08-2 × BBSR-10-25 and BBSR-08-2 × Selection from BBSR-145-1 showed significantly better fruit breadth, fruit weight and fruit plant^{-1} indicating the superiority over the rest of tested F_1 crosses. Results of the present study are in agreement with the reports of Vethamoni and Praneetha [12], Sivakumar et al. [11], Kumar et al. [13], Chinthagunti et al. [15], Khobragade et al. [14], Bajpai et al. [9], Tripathy et al. [10] and Maurya and Yadav [16].

In commercial cultivation of brinjal, the total fruit yield plant^{-1} being a complex character primarily depends upon vegetative growth parameters, flowering, fruit yield and yield attributes. Thus, the F_1 crosses having relatively better vegetative growth, flowering, fruit yield attributes and resistance or tolerance to bacterial wilt should be considered for development of new variety. Considering all the parameters, in the present study showed significant variations for total fruit yield ranging from 1.13 kg (BBSR-10-25 × Selection from BBSR-145-1) to 2.09 kg (BBSR-08-2 × Selection from BBSR-145-1). Significantly higher fruit yield plant^{-1} of 2.09 kg was recorded by F_1 cross, BBSR-08-2 × Selection from BBSR-145-1than the rest of the F_1 crosses except BBSR-08-2 × BBSR-10-25(1.98 kg) and BBSR-08-2 × BBSR-10-26 (1.91 kg) where *statistical parity* was observed. Similar reports of higher fruit yield in F_1 crosses of brinjal was also reported by Sivakumar et al. [11], Chinthagunti et al. [15], Khobragade et al. [14], Dash et al. [8], Bajpai et al [9], Datta et al. [18] and Maurya and Yadav [16].

Conclusion

Thus, considering the *per se* performance among all the 21 F_1 crosses involving local landraces it may be concluded that F_1 crosses such as 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 cultivation due to their significant performance on vegetative, fruit yield attributes and over all high fruit yield plant^{-1}. The study also revealed that, the parent, BBSR-08-2 may be used to induce not only better growth but also higher yield. Similarly, Arka Neelanchal Shyama may be used as parent to induce earliness.

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Table-1: Performance of F_1 crosses of brinjal local landraces for vegetative and flowering parameters

Sl No	F_1 crosses and parents	Plant height at final harvest (cm)	Plant spread (cm) East-West	Plant spread (cm) North - South	Primary branches plant^{-1}	Days to first flowering (days)	Days to 50% flowering (days)
1	BBSR-08-2 × BBSR-10-25	110.90	89.45	91.25	5.00	52.90	62.00
2	BBSR-08-2 × BBSR-10-26	102.75	73.30	76.05	4.30	55.00	65.60
3	BBSR-08-2 × BBSR-09-6	107.25	81.45	86.60	4.40	50.30	62.00
4	BBSR-08-2 × BBSR-195-3	105.85	85.45	88.50	5.00	47.30	59.90
5	BBSR-08-2 × Selection from BBSR-145-1	95.40	82.85	71.35	5.10	54.80	62.10
6	BBSR-08-2 × Arka Neelanchal Shyama	88.85	77.35	76.60	4.50	48.00	58.80
7	BBSR-10-25 × BBSR-10-26	83.45	80.05	73.10	4.70	48.90	57.30
8	BBSR-10-25 × BBSR-09-6	101.25	87.40	83.45	4.30	48.70	60.20
9	BBSR-10-25 × BBSR-195-3	96.95	83.35	72.45	4.50	51.80	58.20
10	BBSR-10-25 × Selection from BBSR-145-1	86.95	73.30	84.75	5.40	47.30	66.20
11	BBSR-10-25 × Arka Neelanchal Shyama	76.85	77.40	71.55	4.50	48.05	61.70
12	BBSR-10-26 × BBSR-09-6	80.70	75.85	76.45	4.50	46.80	60.00
13	BBSR-10-26 × BBSR-195-3	90.15	75.45	74.70	4.50	48.40	62.20
14	BBSR-10-26 × Selection from BBSR-145-1	91.25	72.75	81.00	4.30	45.60	55.00
15	BBSR-10-26 × Arka Neelanchal Shyama	79.80	76.80	77.60	4.70	47.70	55.10
16	BBSR-09-6 ×BBSR-195-3	94.85	81.80	77.95	4.00	47.00	58.40
17	BBSR-09-6 × Selection from BBSR-145-1	83.45	89.55	77.35	4.40	47.00	56.00
18	BBSR-09-6 × Arka Neelanchal Shyama	85.85	87.60	73.45	4.30	47.45	57.90
19	BBSR-195-3 × Selection from BBSR-145-1	78.45	84.60	76.75	4.50	53.90	66.40
20	BBSR-195-3 × Arka Neelanchal Shyama	82.90	87.50	71.35	4.80	50.10	56.50
21	Selection from BBSR-145-1 × Arka Neelanchal Shyama	74.50	84.60	70.00	4.90	48.00	57.95
22	BBSR-08-2	92.40	81.80	77.05	4.70	51.10	59.50
23	BBSR-10-25	73.80	79.80	69.00	4.40	44.70	67.20
24	BBSR-10-26	74.45	78.10	82.45	4.00	44.50	51.10
25	BBSR-09-6	89.75	84.65	74.95	3.50	46.70	58.30
26	BBSR-195-3	90.90	79.35	71.30	4.20	45.40	52.00
27	Selection from BBSR-145-1	75.75	82.90	69.40	3.30	50.40	61.80
28	Arka Neelanchal Shyama	58.80	75.65	74.10	6.50	36.90	46.40
29	Mahy Green (Check)	79.95	75.10	67.90	5.10	47.30	58.50
	GM	87.38	80.87	76.50	4.56	48.34	59.11
	SE(m)±	2.48	1.69	3.43	0.19	0.95	1.16
	CD (P=05)	7.20	4.91	9.95	0.54	2.76	3.37
	CV %	4.02	2.96	6.34	5.77	2.79	2.78

Table-2: Performance of F_1 crosses of brinjal local landraces for fruit yield and yield attributes

Sl No	F_1 crosses and parents	Fruit length (cm)	Fruit breadth (cm)	Fruit weight (cm)	Fruit plant^{-1}	Fruit yield plant^{-1} (kg)
1	BBSR-08-2 × BBSR-10-25	14.45	25.45	198.15	17.55	1.98
2	BBSR-08-2 × BBSR-10-26	14.65	22.90	188.00	13.50	1.91
3	BBSR-08-2 × BBSR-09-6	12.10	19.77	138.20	14.90	1.87
4	BBSR-08-2 × BBSR-195-3	15.95	25.75	182.85	13.70	1.86
5	BBSR-08-2 × Selection from BBSR-145-1	14.70	25.53	206.50	14.20	2.09
6	BBSR-08-2 × Arka Neelanchal Shyama	11.80	22.80	147.80	12.20	1.53
7	BBSR-10-25 × BBSR-10-26	14.70	17.78	127.70	14.30	1.17
8	BBSR-10-25 × BBSR-09-6	11.55	15.35	118.40	11.80	1.39
9	BBSR-10-25 × BBSR-195-3	16.25	25.09	187.30	17.70	1.81
10	BBSR-10-25 × Selection from BBSR-145-1	15.30	24.98	139.95	13.70	1.13
11	BBSR-10-25 × Arka Neelanchal Shyama	12.77	22.45	138.10	13.90	1.32
12	BBSR-10-26 × BBSR-09-6	12.25	18.92	128.65	13.90	1.50
13	BBSR-10-26 × BBSR-195-3	16.20	17.02	177.60	16.30	1.89
14	BBSR-10-26 × Selection from BBSR-145-1	14.05	18.57	140.00	17.10	1.76
15	BBSR-10-26 × Arka Neelanchal Shyama	12.15	20.00	138.05	13.70	1.54
16	BBSR-09-6 ×BBSR-195-3	12.00	15.70	119.70	13.90	1.53
17	BBSR-09-6 × Selection from BBSR-145-1	12.45	15.84	126.60	12.60	1.45
18	BBSR-09-6 × Arka Neelanchal Shyama	11.35	15.70	136.40	12.50	1.49
19	BBSR-195-3 × Selection from BBSR-145-1	16.35	24.80	217.30	12.10	1.50
20	BBSR-195-3 × Arka Neelanchal Shyama	13.40	23.35	169.55	12.50	1.39
21	Selection from BBSR-145-1 × Arka Neelanchal Shyama	13.50	21.10	146.45	14.20	1.42
22	BBSR-08-2	11.75	22.90	129.80	12.60	1.26
23	BBSR-10-25	12.65	20.50	123.40	15.80	1.17
24	BBSR-10-26	12.95	16.75	117.40	18.00	1.48
25	BBSR-09-6	11.00	14.22	98.30	19.90	1.39
26	BBSR-195-3	15.15	19.57	156.50	17.00	1.72
27	Selection from BBSR-145-1	13.86	20.90	149.50	14.20	1.40
28	Arka Neelanchal Shyama	11.65	23.15	156.20	13.10	1.38
29	Mahy Green (Check)	12.00	15.70	112.80	17.00	1.56
	GM	13.41	20.43	148.87	14.62	1.55
	SE(m)±	0.58	1.08	7.72	0.80	0.06
	CD (P=05)	1.68	3.13	22.38	2.32	0.18
	CV %	6.09	7.46	7.33	7.74	5.62