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Per Se Performance of Brinjal (*Solanum melongena* L.) Hybrids for Fruit Yield and its component Traits under Normal and Organic Environments

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ABSTRACT: Eggplant is an economically important vegetable crop with an extensive diversity among landraces and close relatives. An investigation was carried out in brinjal using 7 diverse parents and mated in full diallel fashion to obtain 42 hybrids evaluated with one standard check GJBH-4 in randomized block design with three replications in normal fertilizer (E_1) and organic environment (E_2). Observation recorded on 13 characters fruit yield and its attributing traits. According to *per se* performance for fruit yield per plant JBCL-16-12 × GJB-3, GRB-5 × JBCL-16-12, JBCL-17-01 × GRB-5 and JBCL-16-12 × GJB-2 in normal fertilizer (E_1) and JBCL-16-12 × GJB-2, SB × GRB-5, JBCL-16-12 × GRB-5, GJB-3 × GRB-5 and JBCL-17-01 × GJB-3 in organic environment (E_2) found superior over standard check. These hybrids can be release as a commercial hybrids or further use in breeding programme to obtain elite segregants in respective environment.

Keywords: Brinjal, hybrids, per se performance, fruit yield, normal fertilizer condition, organic condition.

INTRODUCTION

Vegetables occupy an important place in diversification of agriculture and have played a vital role in food and nutritional security of ever-growing population of our large vegetarian society. Development of new varieties with higher nutrient content could be particularly beneficial to poor consumers, but the existing production of brinjal cannot able to meet the ever growing demand of the burgeoning population. Therefore, there is an urgent need for improving the productivity of the crop. Excess use of pesticide and fertilizers cause the entry of harmful compound into food chain, death of natural enemies of insect-pest and imbalance of ecology (Chitale *et al*., 2012). Organic farming is a production system that avoids the use of chemicals fertilizers, growth regulators and pesticides. The soil degradation and reduced soil fertility problem can be overcome by use of organic farming and ecological agriculture (Palaniappan and Annadurai 1999). India acquired eighth position with a total organic agriculture area of 1.78 million hectare (Waller and Lemound 2019). In India traditional farming system, indigenous farmer, extensive drylands and nominal use of chemicals are prominent for long periods of time and moreover adequate rainfall in north-east hilly region of country with few negligible chemicals use provide the natural organic land (Gour, 2016). Therefore, the present investigation was carried out to identify the hybrids for normal fertilizer condition and organic condition.

MATERIAL AND METHODS

The experimental material used in present study consists of 50 test entries comprising of 42 hybrids (F_1s) developed from 7 diverse parental lines and one standard check hybrid (GJBH-4). The crosses were made during *rabi*-2021 at Vegetable Research Station, Junagadh Agricultural University, Junagadh, through full diallel fashion. The experiment was laid out in randomized block (RBD) design with three replications at respective two environments, one with normal fertilizer (E_1) (100: 50: 50 NPK, kg ha^{-1}) at Vegetable Research Station, second with organic environment (E_2)

at Instructional Farm, College of Agriculture, Junagadh during late *Kharif*- 2021-22. Each genotype consisted of a single row of 6 m length with row to row and plant to plant distance of 90 cm and 60 cm, respectively. All the recommended agronomical practices and plant protection measures except, for fruit borer infestation where, unprotected condition was required were followed for raising a normal crop. Observations were recorded on days to first flowering, days to first picking, fruit length, fruit girth, average fruit weight, number of fruits per plant, plant height, number of primary branches, days to last picking, number of pickings, fruit yield per plant, TSS content and fruit borer infestation on five competitive plants randomly selected for all the component characters except, days to first flowering, days to first picking and days to last picking where, observations recorded on plot basis. The analysis of variance is performed to test the significance of difference among the genotypes for all the characters following fixed effect model as suggested by Panse and Sukhatme (1985). In results all the parents and hybrids were compared with standard check's mean value adding or suppressing CD value according to characters in respective environments.

RESULTS

The significant variation found for all the characters in both the environment. The range and mean value for all the characters given in Table 1 and 2. The character wise analysis of all the traits for both the environments is as follow.

Days to first flowering. Earliness is desirable in brinjal. The mean value for days to first flowering in E_1 environment for parents and crosses ranged from 47.00 (GJB-2) to 67.30 (JBCL-10-12), 50.30 (GJB-2 × GRB-5) to 62.70 (GJB-3 × JBCl-10-12), respectively (Table 1). Among parents, GJB-2 (47.00) found earlier over standard check. No one cross found earlier over standard check (49.03) in E_1. In E_2 among the parents and crosses, mean ranged from 53.30 (GJB-2) to 74.00 (JBCL-10-12) and 50.70 (SB × GJB-2) to 73.30 (GJB-3 × JBCl-17-01 and JBCl-10-12 × GJB-3), respectively. Among parents, GJB-2 (53.33) was earlier over standard check. The crosses, GJB-2 × GRB-5 (54.30) and SB × GJB-2 (50.70) were found early over standard check (54.20). Variation among the parents and crosses were found significant in both the environment. Similar pattern was also reported by Nirmala *et al*. (2013); Vethamoni and Praneetha (2016); Kumar *et al*. (2017); Begum *et al.* (2017); Khobragade *et al*. (2019).

Days to first picking. The mean performance in E_1 environment, for parents and crosses, in case of days to first picking varied from 59.00 (GJB-2) to 81.70 (JBCL-10-12) and 62.70 (GRB-5 × GJB-2) to 77.00 (GJB-3 × JBCl-10-12), respectively (Table 1). Among parents, GJB-2 (59.00) was earlier in E_1 over standard check (58.80). None of the cross was found superior over standard check. In E_2, among the parents and crosses, value ranged between 68.00 (GJB-2) to 88.30 (JBCL-10-12) and 67.30 (GJB-2 × GRB-5 and SB × GJB-2) to 86.30 (GJB-3 × JBCl-17-01 and JBCl-10-12 × GJB-3), respectively. None of the parent and cross was found superior over standard check (66.55). Similar findings was also reported by Chowdhury *et al*. (2010); Nirmala *et al*. (2013).

Fruit length (cm). In case of E_1 environment, mean value among parents and crosses, for fruit length varied between 10.00 (GJB-2) to 14.60 (JBCL-16-12) and 9.70 (SB × GJB-3) to 16.80 (JBCl-17-01 × GJB-2), respectively (Table 1). None of the parent was found superior over standard check (14.90). Total 14 crosses found superior over standard check among them five top crosses were SB × JBCL-16-12 (16.90), JBCL-17-01 × GJB-2 (16.80), JBCL-17-01 × JBCL-16-12 (16.70), JBCL-10-12 × JBCL-17-01 (16.60) and JBCL-17-01 × JBCL-10-12 (16.40). In E_2, among the parents and crosses, it ranged from 6.40 (GJB-2) to 11.70 (JBCL-17-01) and 5.50 (GJB-3 × GRB-5) to 16.70 (JBCl-16-12 × JBCl-10-12), respectively. Among parents, JBCL-17-01 (11.70) had higher fruit length over standard check (11.63). Total 12 crosses found superior over standard check among them five top crosses were JBCL-16-12 × JBCL-10-12 (16.70), JBCL-17-01 × JBCL-10-12 (14.40), JBCL-17-01 × JBCL-16-12 (14.30), JBCL-10-12 × GJB-2 (13.70) and SB × JBCL-16-12 (13.50). Similar observations on fruit length have also been reported by Timmapur *et al*. (2007); Satesh kumar *et al*. (2011); Kant *et al.* (2013); Kumar *et al*. (2013); Solaimana *et al.* (2015) in brinjal.

Fruit girth (cm). In case of E_1 environment, parents and crosses mean for fruit girth varied between 13.60 (GJB-2) to 22.20 (GJB-3), 12.60 (GJB-2 × SB) to 26.60 (SB × JBCl-10-12), respectively (Table 1). Among parents, GJB-3 (22.20) and SB (21.80) had higher fruit girth over standard check (18.48). Total 16 crosses found superior over standard check among them five top crosses were SB × JBCL-10-12 (26.60), SB × GRB-5 (25.70), JBCL-16-12 × SB (24.60), GJB-3 × JBCL-16-12 (23.60) and GJB-3 × GRB-5 (23.50). In E_2 among the parents and crosses mean ranged from 10.00 (GJB-2) to 18.70 (SB) and 10.20 (JBCL-10-12 × JBCl-17-01) to 20.00 (GJB-3 × GRB-5), respectively. Among parents, SB (18.70) and GJB-3 (18.20) had higher fruit girth over standard check (12.94). Total 24 crosses found superior over standard check among them top five crosses were GJB-3 × GRB-5 (20.00), SB × GJB-2 (19.60), JBCL-16-12 × SB (19.40), GJB-3 × JBCL-16-12 (19.30) and GJB-3 × GJB-2 (18.90). Similar observations on fruit girth have also been reported by Timmapur *et al*. (2007); Satesh kumar *et al.* (2011); Kant *et al.* (2013); Kumar *et al*. (2013); Solaimana *et al.* (2015); Begum *et al.* (2017) in brinjal.

Average fruit weight (g). In E_1, environment parents and crosses mean for average fruit weight varied between 67.90 (GJB-2) to 135.40 (JBCL-10-12) and 63.60 (SB × JBCl-17-01) to 149.60 (SB × JBCl-10-12),

respectively (Table 1). Among parents, JBCL-10-12 (135.40), JBCL-16-12 (130.30) and GJB-3 (115.40) were reported superior over standard check (101.17). Total 25 crosses were found superior over standard check (101.17) among them top five hybrids were SB × JBCL-10-12 (149.60), JBCL-16-12 × SB (149.50), JBCL-16-12 × GJB-3 (129.00), JBCL-17-01 × GRB-5 (127.00) and GJB-3 × GRB-5 (122.50). In E_2, among the parents and crosses value ranged from 32.20 (GJB-2) to 77.00 (JBCL-16-12) and 38.70 (GJB-3 × GJB-2) to 98.90 (JBCl-10-12 × JBCl-16-12), respectively. Among parents, JBCL-10-12 (75.60), JBCL-16-12 (77.00), GJB-3 (66.80) and SB (67.00) were reported superior over standard check (65.40). Total 15 crosses found superior over standard check (65.40) among them top 5 crosses were JBCL-10-12 × JBCL-16-12 (98.90), GRB-5 × GJB-3 (98.60), JBCL-10-12 × SB (83.40), GJB-3 × GRB-5 (82.20) and GRB-5 × JBCL-10-12 (76.30). Similar observations of significantly higher fruit weight by F_1 crosses than corresponding parents in brinjal have also been reported earlier by Satesh Kumar *et al*. (2011); Kant *et al.* (2013); Kumar *et al*. (2013); Nirmala *et al*. (2013); Solaimana *et al.* (2015); Vethamoni and Praneetha (2016); Begum *et al.* (2017); Khobragade *et al*. (2019).

Number of fruits per plant. In case of E_1 environment mean for number of fruits per plant for parents and crosses ranged between 15.00 (JBCl-10-12) to 25.30 (GJB-2) and 15.00 (JBCl-10-12 × SB) to 30.00 (GJB-2 × JBCl-10-12), respectively (Table 1). None of the parent and cross was recorded superior over standard check (9.37) in E_1. In E_2, among the parents and crosses, value varied from 8.90 (JBCl-10-12) to 18.10 (GJB-2) and 9.80 (GRB-5 × GJB-3) to 18.50 (SB × GRB-5), respectively. Among parents, GJB-2 (18.10) was superior over standard check. The total 7 crosses found superior over standard check (17.55) among them top five crosses were SB × GRB-5 (18.50), GJB-2 × JBCl-16-12 (18.40), JBCl-16-12 × GJB-3 (18.20), JBCl-16-12 × JBCl-10-12 (18.20) and JBCl-17-01 × GJB-2 (18.10). Similar results also obtained by Kumar *et al.* (2013); Solaimana *et al*. (2015); Vidhya *et al.* (2015); Begum *et al.* (2017).

Number of primary branches per plant. In case of E_1 environment parents and crosses mean for number of primary branches per plant ranged from 2.90 (GJB-3) to 6.70 (JBCL-10-12) and 3.30 (GJB-2 × JBCl-17-01) to 9.40 (SB × GJB-3), respectively (Table 2). The cross SB × GJB-3 (9.40) found superior over standard check but, none of the parent found superior over standard check (9.37) in E_1. In E_2, among the parents and crosses, it ranged from 2.90 (GJB-3) to 5.80 (JBCL-10-12) and 3.40 (GJB-3 × GJB-2) to 5.70 (GRB-5 × JBCl-10-12), respectively. Significant variation observed for number of primary branches per plant but none of the parent and cross was found superior over standard check (5.90). Variation for number of primary branches per plant was also reported by Begum *et al.* (2017).

Plant height (cm). In case of E_1 environment parents and crosses mean for plant height ranged from 65.20 (GJB-2) to 99.22 (SB) and 74.13 (GJB-2 × JBCl-17-01) to 103.90 (GRB-5 × JBCl-17-01), respectively (Table 2). Among parents, SB (99.22) was found superior over standard check (91.89) in E_1. Total 19 crosses found superior over standard check among them top five crosses were GRB-5 × JBCL-17-01 (103.90), JBCL-10-12 × GRB-5 (102.50), JBCL-10-12 × SB (101.60), GRB-5 × SB (101.20) and JBCL-16-12 × GRB-5 (100.40). Similar reports of significant variations among the parents and F_1 in brinjal were reported earlier (Nirmala *et al*., 2013; Vethamoni and Praneetha 2016; Kumar *et al*., 2017; Khobragade *et al*., 2019). In E_2, among the parents and crosses it, was ranged from 44.59 (SB) to 67.18 (JBCL-17-01) and 48.46 (JBCl-16-12 × JBCl-17-01) to 77.84 (JBCl-10-12 × GRB-5), respectively. Among parents, JBCL-17-01 (67.18), JBCL-10-12 (61.26) and JBCL-16-12 (58.62) were found superior over standard check. Total 36 crosses found superior over standard check (57.54) among them top five crosses were JBCL-10-12 × GRB-5 (77.84), JBCL-10-12 × JBCL-17-01 (75.60), GRB-5 × JBCL-16-12 (74.11), GLB-2 × JBCl-17-01 (72.53) and JBCL-10-12 × SB (72.34). Due to improved soil properties FYM enables the roots to grow deeper ensuring strong stems and taller plants (Suge *et al*., 2011).

Days to last picking. In E_1 environment parents and crosses mean for days to last picking ranged from 141.30 (GJB-2) to 165.30 (JBCL-10-12) and 160.10 (JBCl-17-01× SB and SB × GRB-2) to 185.00 (GRB-5 × JBCl-16-12), respectively (Table 2). Among parents, JBCL-10-12 (165.30), GRB-5 (164.20) and GJB-3 (163.30) were found superior over standard check (158.61). Total 40 crosses found superior over standard check among them top 5 crosses were GRB-5 × JBCL-16-12 (185.00), SB × JBCL- 16-12 (181.30), JBCL-16-12 × GRB-5 (180.70), JBCL-16-12 × GJB-3 (177.60) and GRB-5 × GJB-3 (175.50). In E_2, among the parents and crosses it, ranged from 128.40 (GJB-2) to 165.60 (GJB-3) and 148.60 (GJB-2 × GRB-5) to 179.20 (SB × JBCl-16-12), respectively. Among parents, GJB-3 (165.60), JBCL-17-01 (159.90), JBCL-16-12 (156.30) and JBCL-10-12 (154.70) were found superior over standard check (154.16). Total 39 crosses found superior over standard check among them top 5 crosses were SB × JBCL-16-12 (179.20), GRB-5 × JBCL- 10-12 (177.80), JBCL- 16-12 × GJB-3 (176.00), SB × JBCL-17-01 (172.20) and GJB-3 × SB (170.00).

Number of pickings. In case of E_1 environment, parents and crosses mean for number of pickings ranged from 11.38 (JBCl-16-12) to 14.15 (GRB-5) and 11.98 (GRB-5 × GJB-3) to 16.67 (GRB-5 × JBCl-16-12), respectively (Table 2). Among parents, GRB-5 (14.15) was reported superior over standard check (13.97). Total 33 crosses found superior over standard check (13.97) among them top 5 crosses were GRB-5 × JBCL-16-12 (16.67), SB × JBCL-16-12 (16.18), JBCL-

16-12 × GRB-5 (16.15), GJB-2 × SB (14.92) and GRB-5 × JBCL-17-01 (14.76). In E_2, among the parents and crosses it, ranged from 7.55 (GJB-2) to 10.08 (GJB-3) and 8.71 (GJB-2 × GJB-3) to 12.60 (SB × JBCl-16-12), respectively. None of the parent found superior over standard check. The total 28 crosses found superior over standard check (10.40) among them top five crosses were SB × JBCL-16-12 (12.60), GRB-5 × JBCL-16-12 (12.47), GJB-2 × JBCL-16-12 (12.04), GRB-5 × JBCL-17-01 (11.92) and SB × JBCL-17-01 (11.77).

Fruit yield per plant (kg).

In case of E_1 environment parents and crosses mean for fruit yield per plant varied from 1.30 (JBCl-17-01) to 2.10 (GRB-5) and 1.20 (SB × GJB-3) to 3.60 (JBCl-16-12 × GJB-3), respectively. Total 4 crosses found superior over standard check (2.70) among them top crosses were JBCL-16-12 × GJB-3 (3.60), GRB-5 × JBCL-16-12 (3.30), JBCL-17-01 × GRB-5 (2.90) and JBCL-16-12 × GJB-2 (2.80). Similar reports of superiority of fruit yield also reported by Begum *et al.* (2017); Yadav *et al.* (2017); Tiwari *et al.* (2019); Datta *et al*. (2021). In E_2, among the parents and crosses, it ranged from 0.50 (GJB-2 and GRB-5) to 0.80 (GJB-3 and SB) and 0.30 (GJB-3 × JBCl-17-01) to 1.20 (JBCl-16-12 × GJB-2 and SB × GRB-5), respectively. Total 5 crosses found superior over standard check (0.99) were JBCL-16-12 × GJB-2 (1.20), SB × GRB-5 (1.20), JBCL-16-12 × GRB-5 (1.10), GJB-3 × GRB-5 (1.10) and JBCL-17-01 × GJB-3 (1.10). Some hybrids given good yield in organic environment over standard check. It was also supported by Chindo and Khan (1986) findings i.e. additions of suitable organic manure in the soil improves the soil structure and hence, encourages the plant root growth and lead to higher yields.

TSS content (°B). In case of E_1 environment parents and crosses mean for TSS content ranged from 7.30 (GJB-2) to 9.10 (GJB-3 and GRB-5) and 6.80 (JBCl-16-12 × GJB-2) to 8.30 (GJB-3 × JBCl-17-01), respectively (Table 2). None of the parent and cross was found superior over standard check (9.55). In E_2, among the parents and crosses it varied from 7.20 (JBCl-16-12) to 8.90 (GJB-3 and GRB-5) and 6.70 (SB × JBCl-16-12) to 8.50 (SB × JBCl-10-12), respectively. None of the parent and cross was found superior over standard check (9.71). Overall TSS content was higher in organic environment than normal fertilizer condition due to increased uptake of N and P which resulted in increased plant weight due to increased number of leaves and branches led to better carbohydrate build up which increased the plant fruit yield and their quality components. Similar findings were also reported by Suge *et al.* (2011).

Fruit borer infestation (%). In case of E_1 environment parents and crosses mean for fruit borer infestation ranged from 6.38 (GJB-2) to 19.15 (JBCL-17-01) and 1.86 (GJB-3 × SB) to 35.03 (JBCl-17-01 × GJB-3), respectively (Table 2). Among parents, GJB-2 (6.38), GRB-5 (7.39) and SB (8.60) were reported superior over standard check (10.39). The total 28 crosses were superior over standard check (10.39) among them top 5 crosses were GJB-3 × SB (1.86), GJB-3 × JBCL-17-01 (2.00), SB × GJB-3 (3.56), JBCL-16-12 × GRB-5 (4.44) and JBCL-16-12 × JBCL-10-12 (4.44). In E_2, among the parents and crosses, mean value ranged from 6.72 (GJB-2) to 18.63 (JBCL-17-01) and 1.66 (GJB-3 × SB) to 34.95 (JBCl-17-01 × GJB-3), respectively. Among parents, GJB-2 (6.72), GRB-5 (7.16), SB (8.06) and JBCL-16-12 (8.60) were reported superior over standard check (9.37). The total 26 crosses found superior over standard check (9.37) among them top five crosses were GJB-3 × SB (1.66), GJB-3 × JBCL-17-01 (2.00), SB × GJB-3 (2.57), JBCL-16-12 × GRB-5 (3.55) and JBCL-17-01 × SB (4.32). The lowest shoot and fruit borer infestation was reported by Praneetha (2002); Kamalakkannan *et al.* (2007); Kalpana Dahatonde *et al.* (2010).

CONCLUSION

The significant variation for fruit yield and its component traits were observed in normal fertilizer condition (E_1) as well as organic environment (E_2). The slow release of nutrient in organic environment resulting in inferior mean value of fruit yield and its component traits *viz.*, days to first flowering, days to first picking, fruit length, fruit girth, average fruit weight, number of fruits per plant, number of primary branches, plant height, days to last picking, number of pickings. The quality parameter TSS content and less fruit borer infestation were good in organic environment. According to fruit yield per plant JBCL-16-12 × GJB-3, GRB-5 × JBCL-16-12, JBCL-17-01 × GRB-5 and JBCL-16-12 × GJB-2 in normal fertilizer (E_1) and JBCL-16-12 × GJB-2, SB × GRB-5, JBCL-16-12 × GRB-5, GJB-3 × GRB-5 and JBCL-17-01 × GJB-3 in organic environment (E_2) found superior over standard check. These hybrids also superior for fruit yield component traits and can exploit as a hybrid variety at commercial level in normal and organic environment and also further utilized in breeding programme. It conclude from above study the separate breeding programme as well as breeding material required for successful variety development for normal and organic environments.

Table 1: Mean value of parents and crosses for days to first flowering, days to first picking and fruit length (cm), fruit girth (cm), average fruit weight (cm) and number of fruits per plant in E_1 and E_2 environments.

Sr. No.	Genotypes	Days to first flowering		Days to first picking		Fruit length (cm)		Fruit girth (cm)		Average fruit weight (g)		Number of fruits per plant	
		E_1	E_2	E_1	E_2	E_1	E_2	E_1	E_2	E_1	E_2	E_1	E_2
1	GJB-2	47.00	53.30	59.00	68.00	10.00	6.40	13.60	10.00	67.90	33.20	25.30	18.10
2	GJB-3	63.70	70.00	77.70	85.00	12.20	7.50	22.20	18.20	115.40	66.80	16.70	12.20
3	GRB-5	53.00	58.00	65.00	76.30	10.50	10.50	17.80	12.60	87.60	48.20	24.30	10.30
4	JBCL-10-12	67.30	74.00	81.70	88.30	14.50	10.30	14.70	11.90	135.40	75.60	15.00	8.90
5	JBCL-16-12	56.30	67.00	71.30	83.00	14.60	10.30	15.10	10.60	130.30	77.00	15.70	9.40
6	JBCL-17-01	56.00	65.30	67.00	80.30	14.20	11.70	13.80	12.70	68.10	54.60	20.00	12.70
7	Swarna Mani Black	54.30	64.70	67.30	78.30	13.70	9.80	21.80	18.70	86.50	67.00	23.00	12.40
	Parental mean	**56.80**	**64.60**	**69.90**	**79.90**	**12.80**	**9.50**	**17.00**	**13.53**	**98.70**	**60.40**	**20.00**	**12.00**
8	GJB-2 × GJB-3	54.70	65.30	67.70	79.00	11.20	11.20	18.40	15.70	103.30	75.60	22.30	12.10
9	GJB-2 × GRB-5	50.30	54.30	63.30	67.30	10.30	9.00	16.60	12.90	83.60	55.30	16.00	11.00
10	GJB-2 × JBCL-10-12	54.30	66.70	68.30	80.70	13.50	8.20	17.20	14.20	109.20	55.70	30.00	16.90
11	GJB-2 × JBCL-16-12	52.30	56.30	66.30	70.30	13.40	11.90	15.30	11.90	102.30	58.80	26.00	18.40
12	GJB -2 × JBCL- 17-01	52.70	56.70	65.70	69.70	13.30	12.50	17.40	13.00	106.80	65.60	17.00	12.00
13	GJB-2 × SB	51.00	57.30	64.00	70.30	12.40	11.40	12.60	9.60	93.40	73.20	18.00	13.20
14	GJB-3 × GJB-2	55.30	59.30	68.30	72.30	12.70	8.20	23.00	18.90	120.90	38.70	19.70	15.70
15	GJB-3 × GRB-5	59.00	70.00	72.00	83.70	12.80	5.50	23.50	20.00	122.50	82.20	18.30	13.80
16	GJB-3 × JBCL-10-12	62.70	72.00	77.00	85.70	13.90	8.50	14.40	13.00	101.90	46.00	17.70	10.40
17	GJB-3 × JBCL-16-12	59.30	64.30	74.30	79.30	13.20	8.50	23.60	19.30	103.90	40.50	16.70	12.00
18	GJB-3 × JBCL- 17-01	60.00	73.30	73.70	86.30	15.90	7.90	15.50	12.80	101.50	36.40	14.30	10.10
19	GJB-3 × SB	60.00	68.00	72.30	82.00	12.50	11.50	19.90	12.10	106.20	64.20	18.70	12.10
20	GRB-5 × GJB-2	50.70	62.70	62.70	77.00	12.40	10.40	22.60	18.30	89.90	64.50	19.00	10.60
21	GRB-5 × GJB-3	60.70	68.70	75.70	82.30	13.30	10.60	21.20	18.20	92.40	98.60	16.30	9.80
22	GRB-5 × JBCL-10-12	58.30	63.30	72.30	80.30	12.10	10.80	16.40	11.00	87.90	76.30	24.70	14.30
23	GRB-5 × JBCL-16-12	55.30	64.30	68.30	78.00	14.80	9.30	21.90	13.30	128.20	52.80	26.00	17.20
24	GRB-5 × JBCL-17-01	54.00	57.00	67.00	70.00	13.70	11.20	15.50	12.10	105.10	63.50	18.30	14.30
25	GRB-5 × SB	53.70	55.30	66.70	68.70	11.40	13.50	20.90	17.80	103.30	75.60	15.00	11.60
26	JBCL-10-12 × GJB-2	54.70	67.00	66.70	80.70	13.00	13.70	15.80	11.60	83.60	55.30	15.30	12.30
27	JBCL-10-12 × GJB-3	62.30	73.30	75.30	86.30	13.50	10.40	17.40	14.30	109.20	55.70	19.30	14.80
28	JBCL-10-12 × GRB-5	59.30	67.00	73.30	80.70	13.60	12.40	16.00	11.40	109.00	66.50	18.70	12.90
29	JBCL-10-12 × JBCL-16-12	61.00	66.00	76.00	79.30	12.00	10.40	12.70	11.10	89.10	98.90	16.70	10.00
30	JBCL-10-12 × JBCL-17-01	58.70	62.70	72.70	76.00	16.60	11.30	13.30	10.20	115.50	42.60	20.00	12.40
31	JBCL-10-12 × SB	59.30	70.00	72.30	83.30	13.80	7.50	17.40	12.40	97.20	83.40	15.00	10.60
32	JBCL-16-12 × GJB-2	52.00	63.00	65.00	77.70	13.60	11.40	17.00	14.50	109.40	75.80	27.00	16.20
33	JBCL-16-12 × GJB-3	61.30	69.70	75.30	83.70	13.10	9.30	15.40	12.40	129.00	62.10	29.00	18.20
34	JBCL-16-12 × GRB-5	62.00	67.70	76.00	15.40	13.10	16.40	12.00	114.00	74.40	20.30	15.00	
35	JBCL-16-12 × JBCL-10-12	60.00	69.00	75.00	83.00	13.30	16.70	15.50	13.20	121.60	52.60	21.00	18.20
36	JBCL-16-12 × JBCL- 17-01	57.00	66.30	70.00	80.30	16.30	11.50	14.20	13.50	117.50	53.60	23.00	13.00

37	JBCL-16-12 × SB	60.00	63.00	73.00	77.00	15.80	11.80	24.60	19.40	149.50	65.70	18.30	12.90
38	JBCL-17-01 × GJB-2	52.30	58.30	65.30	72.30	16.80	12.00	15.50	11.50	96.50	52.60	24.30	18.10
39	JBCL-17-01 × GJB-3	60.00	64.00	74.00	77.30	15.70	8.60	18.50	14.50	120.10	74.40	24.30	17.10
40	JBCL-17-01 × GRB-5	55.30	61.30	68.30	74.30	14.20	8.50	19.60	14.90	127.00	49.80	25.30	17.10
41	JBCL-17-01 × JBCL-10-12	59.70	64.70	73.30	78.30	16.40	14.40	16.30	13.50	84.30	71.70	16.00	11.20
42	JBCL-17-01 × JBCL-16-12	57.70	69.00	71.70	83.30	16.70	14.30	20.00	14.40	101.90	46.70	23.00	17.90
43	JBCL-17-01 × SB	57.30	68.00	70.30	81.70	15.90	7.30	16.60	13.00	76.90	41.20	22.00	17.80
44	SB × GJB-2	52.00	50.70	64.00	67.30	13.10	8.10	23.50	19.60	111.60	60.30	16.00	10.10
45	SB × GJB-3	59.70	63.30	72.70	77.00	9.70	7.70	15.30	11.40	71.90	68.70	17.00	12.40
46	SB × GRB-5	54.30	63.00	67.30	76.00	15.30	8.60	25.70	18.40	97.90	65.30	21.70	18.50
47	SB × JBCL-10-12	59.70	68.00	72.70	83.30	16.40	10.30	26.60	18.70	149.60	56.70	16.00	11.10
48	SB × JBCL-16-12	56.00	64.30	68.00	78.30	16.90	13.50	22.60	18.40	120.30	72.40	20.30	13.50
49	SB × JBCL-17-01	56.00	65.30	68.00	78.00	16.10	7.30	13.30	10.20	63.60	54.80	23.00	15.50
50	GJBH-4 (Standard check)	53.70	60.00	65.30	73.00	12.70	9.50	16.40	11.60	83.70	54.00	27.70	15.10
	SEm ±	1.66	2.07	2.32	2.30	0.78	0.76	0.74	0.48	6.22	4.04	1.37	0.87
	CD@5%	4.67	5.80	6.50	6.45	2.20	2.13	2.08	1.34	17.47	11.40	3.84	2.45
	CV%	5.08	5.58	5.73	5.10	9.85	12.74	7.13	5.86	10.32	11.30	11.70	11.10

Table 2: Mean value of parents and crosses for number of primary branches, plant height (cm), days to last picking, number of pickings, fruit yield per plant, TSS content and fruit borer infestation in E_1 and E_2 environments.

Sr. No.	Genotypes	Number of primary branches		Plant height (cm)		Days to last pickings		Number of pickings		Fruit yield per plant (kg/plant)		TSS content (°B)		Fruit borer infestation (%)	
		E_1	E_2	E_1	E_2	E_1	E_2	E_1	E_2	E_1	E_2	E_1	E_2	E_1	E_2
1	GJB-2	5.20	5.40	65.20	51.67	141.30	128.40	11.76	7.55	1.60	0.50	7.30	7.50	6.38	6.72
2	GJB-3	2.90	2.90	76.83	52.62	163.30	165.60	12.24	10.08	1.90	0.80	9.10	8.90	10.47	10.41
3	GRB-5	4.00	4.50	86.74	48.61	164.20	152.70	14.15	9.54	2.10	0.50	9.10	8.90	7.39	7.16
4	JBCL-10-12	6.70	5.80	79.55	61.26	165.30	154.70	12.75	8.29	2.00	0.60	7.40	7.70	16.60	15.50
5	JBCL-16-12	3.80	4.50	82.60	58.62	151.00	156.30	11.38	9.16	2.00	0.70	6.90	7.20	9.48	8.60
6	JBCL-17-01	4.00	4.10	77.50	67.18	154.60	159.90	12.52	9.95	1.30	0.60	8.10	7.40	19.15	18.63
7	Swarna Mani Black	6.20	4.20	99.22	44.59	151.30	153.50	11.99	9.40	1.90	0.80	7.40	8.40	8.60	8.06
8	GJB-2 × GJB-3	3.60	4.30	74.73	61.68	164.70	148.70	13.86	8.71	2.20	0.90	7.50	7.10	9.59	9.53
9	GJB-2 × GRB-5	4.20	4.10	85.07	63.46	160.50	148.60	13.88	10.16	1.30	0.60	7.60	7.20	7.43	5.49
10	GJB-2 × JBCL-10-12	5.30	4.80	89.43	66.84	157.00	156.80	12.67	9.52	3.00	0.90	7.40	7.90	5.12	5.24
11	GJB-2 × JBCL-16-12	4.40	5.10	80.90	70.15	168.30	166.60	14.56	12.04	2.60	1.00	7.20	8.20	9.02	9.28
12	GJB -2 × JBCL- 17-01	3.30	3.90	74.13	72.53	166.30	152.70	14.42	10.38	1.80	0.80	7.70	7.50	8.84	6.41
13	GJB-2 × SB	4.80	5.20	78.46	64.23	168.40	163.90	14.92	11.69	1.60	0.90	7.60	6.90	12.34	12.49
14	GJB-3 × GJB-2	3.70	3.40	80.17	61.33	172.30	162.30	14.70	11.25	2.30	0.60	7.30	7.50	6.00	6.09
15	GJB-3 × GRB-5	4.30	4.40	85.13	61.52	173.30	159.00	14.46	9.42	2.20	1.10	7.10	7.50	9.06	10.58
16	GJB-3 × JBCL-10-12	4.60	5.30	88.97	58.05	173.10	155.70	13.70	8.75	1.80	0.40	8.20	8.30	8.06	7.27
17	GJB-3 × JBCL-16-12	4.10	5.40	80.74	67.60	170.30	169.30	13.73	11.25	1.70	0.50	7.20	7.60	8.56	8.44
18	GJB-3 × JBCL- 17-01	4.40	5.50	80.69	58.61	174.20	164.40	14.36	9.76	1.40	0.30	8.30	7.30	2.00	2.00
19	GJB-3 × SB	5.50	5.10	85.40	59.62	165.40	170.00	13.30	11.00	1.90	0.80	8.10	8.30	1.86	1.66

20	GRB-5 × GJB-2	5.40	5.50	94.88	58.52	163.10	161.70	14.37	10.58	1.60	0.70	7.10	7.20	10.66	9.97
21	GRB-5 × GJB-3	5.40	5.20	90.85	58.51	175.50	160.10	11.98	9.72	1.40	0.90	7.30	7.30	5.37	5.32
22	GRB-5 × JBCL-10-12	4.20	5.70	93.84	68.08	157.60	160.00	12.18	9.96	2.00	1.00	7.40	7.90	10.65	10.41
23	GRB-5 × JBCL-16-12	4.40	4.70	96.75	74.11	185.00	177.80	16.67	12.47	3.30	0.90	7.50	7.40	6.63	6.16
24	GRB-5 × JBCL-17-01	5.20	5.00	103.90	65.85	170.40	165.40	14.76	11.92	1.90	0.90	7.60	7.60	4.82	4.66
25	GRB-5 × SB	4.40	5.20	101.20	63.36	168.10	160.00	14.49	11.42	1.30	0.70	7.30	8.20	4.75	4.92
26	JBCL-10-12 × GJB-2	5.00	5.50	99.49	59.43	158.70	161.00	13.13	10.05	1.50	0.60	7.20	7.90	11.53	11.39
27	JBCL-10-12 × GJB-3	5.30	4.40	80.43	48.95	165.90	162.70	12.94	9.54	2.30	0.90	7.60	7.50	21.48	21.29
28	JBCL-10-12 × GRB-5	7.50	5.40	102.50	77.84	166.70	165.30	13.35	10.58	2.00	0.80	7.50	7.50	7.46	6.38
29	JBCL-10-12 × JBCL-16-12	3.60	5.50	81.43	62.67	170.50	155.30	13.50	9.49	1.40	0.90	8.10	7.50	8.80	8.67
30	JBCL-10-12 × JBCL-17-01	5.50	5.40	97.16	75.60	171.00	164.10	14.04	11.01	2.20	0.50	7.10	8.00	8.81	8.84
31	JBCL-10-12 × SB	5.30	5.20	101.60	72.34	171.50	166.30	14.17	10.38	1.40	0.80	7.60	7.30	9.59	8.72
32	JBCL-16-12 × GJB-2	5.20	4.70	85.20	60.22	168.20	169.40	14.74	11.47	2.80	1.20	6.80	7.10	15.45	14.45
33	JBCL-16-12 × GJB-3	5.20	4.80	94.33	60.84	177.60	176.00	14.59	11.54	3.60	1.00	7.30	7.10	12.97	12.30
34	JBCL-16-12 × GRB-5	4.70	4.30	100.40	52.65	180.70	170.00	16.15	11.75	2.20	1.10	8.20	7.10	4.44	3.55
35	JBCL-16-12 × JBCL-10-12	5.20	5.20	91.82	52.21	174.60	168.00	14.26	10.63	2.40	0.90	7.10	6.90	4.44	4.71
36	JBCL-16-12 × JBCL- 17-01	5.50	4.80	99.75	48.46	171.90	165.40	14.56	10.64	2.60	0.70	7.00	8.10	17.43	18.08
37	JBCL-16-12 × SB	5.00	5.10	92.16	64.35	169.90	165.30	13.85	11.03	2.60	0.80	7.00	7.10	21.74	20.05
38	JBCL-17-01 × GJB-2	5.20	5.10	77.63	56.94	165.10	162.20	14.25	11.23	2.40	0.90	7.60	7.80	7.13	6.70
39	JBCL-17-01 × GJB-3	4.80	4.10	78.19	68.25	168.10	169.10	13.58	11.47	2.70	1.10	7.50	8.30	35.03	34.95
40	JBCL-17-01 × GRB-5	5.30	4.20	96.49	62.50	164.50	165.30	13.74	11.38	2.90	0.80	7.70	7.50	19.53	18.45
41	JBCL-17-01 × JBCL-10-12	5.10	4.30	88.37	70.25	174.70	164.70	14.49	10.79	1.30	0.70	8.20	7.80	15.52	14.55
42	JBCL-17-01 × JBCL-16-12	5.30	4.20	99.63	70.81	170.80	170.80	14.16	10.93	2.30	0.80	8.10	7.60	12.53	11.62
43	JBCL-17-01 × SB	5.70	4.20	95.26	63.61	160.10	160.20	12.82	9.81	1.60	0.70	7.40	8.30	4.94	4.32
44	SB × GJB-2	8.60	5.20	83.25	62.72	160.10	156.00	13.73	11.08	1.70	0.60	7.50	7.90	6.27	6.64
45	SB × GJB-3	9.40	5.30	80.77	60.83	165.90	169.00	13.33	11.50	1.20	0.80	7.70	7.50	3.56	2.57
46	SB × GRB-5	6.60	5.10	97.18	62.83	168.30	165.30	14.43	11.17	2.00	1.20	7.40	7.90	7.52	8.08
47	SB × JBCL-10-12	7.10	4.30	96.31	71.08	170.10	170.80	13.90	10.93	2.30	0.60	7.20	8.50	10.46	9.42
48	SB × JBCL-16-12	6.10	5.10	100.20	55.18	181.30	179.20	16.18	12.60	2.20	0.90	7.30	6.70	9.76	8.05
49	SB × JBCL-17-01	5.20	4.40	80.54	66.81	161.30	172.20	13.32	11.77	1.40	0.80	7.50	7.50	6.13	7.32
50	GJBH-4 (Standard check)	8.40	5.20	75.81	44.53	150.10	145.30	12.11	9.04	2.20	0.80	8.90	9.20	11.65	10.37
	SEm ±	0.34	0.25	5.73	4.63	3.03	3.16	0.45	0.49	0.18	0.07	0.23	0.18	0.45	0.36
	CD@5%	0.97	0.70	16.08	13.01	8.51	8.86	1.26	1.36	0.50	0.19	0.65	0.51	1.26	1.00
	CV%	11.50	8.99	11.25	12.99	3.15	3.37	5.63	8.01	15.36	14.93	5.27	4.08	7.80	6.40

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