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Phenotypic Stability for Fruit yield and its Components of Brinjal

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ABSTRACT

The present study was carried out at Vegetable Research Station, ARI, Rajendranagar, Hyderabad, Telangana State, India during *kharif* (June–October, 2014), *rabi* (October–February, 2014–15) and Summer (February–May, 2015) to assess the performance of genotypes in terms of yield as well as quality across seasons under wide range of environments through phenotypic stability studies. Thirty brinjal genotypes were evaluated for yield and quality parameters under three environments comprising of three different seasons. The portioning of environments + (genotypes × environments) mean squares showed that environments (linear) differed significantly and were quite diverse with regards to their effect on the performance of the genotypes for fruit yield and quality traits. A perusal of stability parameters indicated two genotypes C_3 and P_6 showed stable performance for earliness, C_3 for days to first fruit harvest and C_3, C_{10}, C_{16}, C_{21}, P_1 for days to last fruit harvest hence these genotypes were adapted to all types of environments. Among the stable hybrids, five hybrids C_3, C_{11}, C_{13}, C_{16} and C_{21} were significantly more yield plant^{-1} and more number of marketable fruits plant $^{-1}$ over the best check Chhaya. Whereas, for ascorbic acid content 5 hybrids i.e C_2, C_4, C_{11}, C_{14} and C_{18} to be stable over the check Utkarsha. C_3 was showed stable performance over best check Chhaya for the trait fruit and shoot borer infestation on shoots and four hybrids C_3, C_{11}, C_{13} and C_{21} were found to be stable for the trait fruit and shoot borer infetstation on fruits over the best check Chhaya.

KEYWORDS: Brinjal, environment, genotypes, hybrids, quality parameters, stability, yield

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1. INTRODUCTION

Brinjal is one of the popular vegetable crops grown in the subtropics and tropics, therefore, can play a vital role in achieving the nutritional security. India has more diversity of the crop, being the origin place of the crop.

The area under the brinjal cultivation in India is about 757.57 thousand hectares with production of 13153.52 thousand metric tonnes. The productivity was 17.36 mt ha^{-1}. (Anonymous, 2020). Being an important source of plant-derived nutrients, the identification crop of brinjal genotypes with higher nutrients and better consumer preference could be beneficial for society, particularly for poor consumers (Gogoi et al., 2018, Shankar et al., 2022). Brinjal is a stable vegetable high in nutritive value. It is low in fat and high in dietary fiber. It contains mostly water, some protein and carbohydrates besides it is a good source of nutrients such as ascorbic acid, vitamin K, niacin, vitamin B_6, pantothenic acid and rich in minerals like Ca, Mg, P, K and Fe. Nutritive value of brinjal is well compared with tomato (Suneetha et al., 2006, Tiwari and Lal, 2014, Dhaka et al., 2017, Akhtar et al., 2019 and Djidonou et al., 2020). They are also known to have alkaloid solanine in roots and leaves. Some medicinal uses of brinjal include treatment of diabetes, asthma, cholera and bronchitis. Fruits and leaves are administered to lower blood cholesterol levels. It is rich in total water soluble sugars, free reducing sugars, amide proteins among other nutrients. Amino acid content is higher in purple varieties. It also has Ayurvedic properties. The fruits are excellent remedies for those suffering from lever troubles (Kumari et al., 2020). Extracts of brinjal are known to have significant effect in reducing blood and liver cholesterol rates (Karak et al., 2012, Dhakre and Bhattacharya, 2013, Taher et al., 2017, Kumar et al., 2018).

Phenotypically stable genotypes (varieties/hybrids) are of high importance, because environmental condition differs from season to season. Wide adaptation to a particular environment and constant performance of suggested genotypes is one of the main objectives in breeding programme. Brinjal is grown round the year and is highly influenced by diverse agro-climatic conditions (Mehta et al., 2011, Dia et al., 2016, Taher et al., 2017, Akhtar et al., 2019). Therefore, it is necessary to improve varieties or hybrids having stable performance through environments. Precise knowledge on the nature and magnitude of genotype x environment interactions is important in indulgent the stability in yield of a particular variety or hybrid before it is being recommended for a given situation. Testing of genotype under different environments differing in unpredictable variation is a known approach for selecting stable genotypes. In order to identify stable genotypes, the genotype by environment interactions must be partitioned into stability statistics that are assignable to each genotype evaluated across a range of environments. Stability indices have allowed researchers to identify widely adapted genotypes for use in breeding programmes (Chaurasia et al., 2005, Dhakre and Bhattacharya, 2013, Dia et al., 2016, Raghavendra et al., 2017a, Kumar et al., 2017, Koundinya et al., 2019, Kumari et al., 2020, Khankahdani et al., 2021).

In Telangana, brinjal is grown as a vegetable crop under varied climatic conditions, it is necessary to develop varieties or hybrids having stable performance over varied environments. However, a very scanty work is being reported regarding the stability analysis of quality and yield traits in brinjal in and outside the country. Therefore, the present investigation was carried out to determine the stable genotypes both in terms of yield as well as qualitative traits which are suitable to Telangana sate.

2. MATERIALS AND METHODS

Thirty genotypes of Brinjal (*Solanum melongena* L.) were assessed over three environments i.e., *kharif* (June–October) of 2014, *rabi* (October–February) of 2014 and Summer (February–May) of 2015 at Vegetable Research station, ARI, Rajendranagar, Hyderabad, Telengana state, India. The farm is located at an altitude of 542.6 m above mean sea level. Geographically it lies at latitude of 17.19° N and a longitude of 79.23° E. The study materials were developed by a randomized complete block design (RCBD) with three replications. The seeds were sown in the nursery during the second week of June, 2014, first week of October, 2014 and February, 2015 the seedlings were transplanted 35 days after sowing in a randomized block design at 50×50 cm^2 spacing with three replications. Standard cultural practices were followed to raise the normal crop. The data were recorded on five randomly selected plants in each treatment over replications for eight characters *viz*., days to first flowering, days to first fruit harvest, days to last fruit harvest, number of marketable fruits $plant^{-1}$ (g), marketable yield $plant^{-1}$ (g), Ascorbic acid content (mg 100 g^{-1}), fruit and shoot borer infestation on shoots (%) and fruit and shoot borer infestation on fruits (%).

The genotype (G)×environment (E) interaction was calculated by the pooled analysis of variance. The mean value of genotypes for unlike traits under different environments was castoff for this analysis. The analysis of stability parameters was assessed by the model suggested by Eberhart and Russel (1966).

$$Yij=m+Bi\ Ij+\partial ij$$

Where: Yij is mean of i^{th} variety in j^{th} environment, m is mean of entire varieties over all environments, Bi is regression coefficient of i^{th} variety on environmental index; which measures the response of this variety to varying environments, I^j is environmental index i.e. the deviation of the mean of all the varieties at a given environment from the overall mean, and ∂^{ij} is the deviation from regression of i^{th} variety at j^{th} environment.

3. RESULTS AND DISCUSSION

Pooled analysis of variance over environments as presented in Table 1 indicates that variances due to brinjal genotypes were highly significant for both the traits which revealed the presence of genetic variability among the genotypes.

The mean sum of square due to environments was significant for all the characters which indicated genotypes interacted with environments significantly. The presence of genotypes ×environment interaction were also significant for all the traits which provides an opportunity for selecting suitable genotypes with high mean for the trait of interest except non-significant mean square value for days to first flowering and days to last fruit harvest which means less variation and least scope of selection for this trait. The presence of both significant and non-significant interactions indicated the differential response of genotype to various environment conditions. Significant mean squares due to environment+ (genotype×environment) were observed for six characters which emphasizing the existence of G×E interactions for these traits. Similar reports were earlier made by Vaddoria et al., 2009a, Tiwari and Lal, 2014 and Koundinya et al., 2019.

Table 1: Analysis of Variance for stability of brinjal

Source of variation	d.f.	Days to first flowering	Days to first fruit harvest	Days to last fruit harvest	No. of marketable fruits plant^{-1}	Marketable yield plant^{-1} (g)	Ascorbic acid content (mg 100 g^{-1})	FSBIS	FSBIF
Replications within Environment	6.00	1.50	1.01	5.63	0.33	1305.75	0.02	0.33	0.58
Genotypes	29.00	13.67**	12.97**	36.83**	27.18**	122516.22**	8.00**	3.04*	12.97**
Environments+ (Genotype× Environment)	60.00	3.08*	3.27*	10.17**	1.58	9883.88*	0.16	2.90*	2.66**
Environments	2.00	41.21**	26.59**	204.81**	10.37**	158692.72**	2.18**	33.76**	35.65**
Genotypes× Environment	58.00	1.76	2.47	3.46	1.28*	4752.54**	0.09**	1.83**	1.53**
Environments (Linear)	1.00	82.41**	53.19**	409.61**	20.74**	317385.44**	4.36**	67.51**	71.31**
Genotypes ×Environment (Linear)	29.00	1.92	3.34*	2.87	1.39**	4842.77**	0.08*	1.99**	1.82**
Pooled Deviation	30.00	1.55	1.54**	3.91**	1.13	4506.90*	0.09**	1.62**	1.19
Pooled Error	174.00	1.53	1.93	2.77	0.87	2560.47	0.03	0.26	1.07
Total	89.00	6.53	6.43	18.86	9.92	46584.30	2.71	2.94	6.02

FSBIS: Fruit and shoot borer infestation on shoots (%) (ASIN); FSBIF: Fruit and shoot borer infestation on fruits (%) (ASIN)

The linear contribution of the environmental effects on the performance of genotypes was significant for all the traits under study. Significant differences due to G×E (linear) indicated that different genotypes differ genetically in their response to different environments except for days to first flowering and days to last fruit harvest which is in accordance with the observations of Kumar et al., 2017 and Kumari et al., 2020 in brinjal. The mean sum of squares for pooled deviation was significant for five characters except days to first flowering, number of marketable fruits per plant and fruit and shoot borer infestation on fruits indicating that the deviation from linear regression contributed substantially towards the difference in stability of genotypes. Similar findings were also reported by Gogoi et al., 2018 and Pacheco et al., 2020.

To assess the stability of genotype regression coefficient (bi) is considered as a parameter of response of a particular genotype and deviation from regression (S^2di) as a parameter of stability. Hence, the mean performance of genotypes, along with both parameters i.e., regression coefficient (bi) and deviation from regression (S^2di) were estimated and are presented in Table 2. The genotypes with regression coefficient (bi) near to unity (1) and non-significant deviation from regression (S^2di) were considered as stable genotypes as their performance can be predicated over the environment.

Days to first flowering among the genotypes ranged between 41.85 (C_3) to 51.32 (P_1) days with a general mean of 45.11 days (Table 2). The stability parameters high mean, bi=1 and S^2di=0) for days to first flowering, showed that out of 30 genotypes, one hybrid C_3 (41.85 days) and parent P_6 (41.99

Table 2: Stability factors for days to first flowering and days to first fruit harvest in brinjal

Genotypes		Days to first flowering			Days to first fruit harvest		
		µ Mean	bi	S^2di	µ Mean	bi	S^2di
P_1	IC-281104	51.32	1.61	-1.48	67.63	2.41	3.03
P_2	IC-021621	45.62	0.44	0.03	62.88	-0.90	3.73
P_3	IC-127024	42.84	0.08	-1.50	59.69	-0.54	-1.49
P_4	IC-090084-2	44.15	1.79*	-1.53	61.70	0.16	-1.21
P_5	IC-090084-4	45.07	1.65	2.26	62.01	2.40*	-1.90
P_6	IC-090783-3	41.99	1.04	-1.52	60.11	0.20	-1.64
P_7	IC-23771	49.83	-0.11	1.68	67.41	-1.21	-1.63
C_1 (P_1×P_2)	IC-281104×IC-021621	46.46	-0.19	0.03	63.43	0.37	0.39
C_2 (P_1×P_3)	IC-281104×IC-127024	48.04	1.61	2.70	64.79	2.87	2.12
C3 (P_1×P_4)	IC-281104×IC-090084-2	41.85	0.78	-1.53	59.32	0.03	-1.15
C_4 (P_1×P_5)	IC-281104×IC-090084-4	45.15	1.79	-1.00	62.55	1.25	-1.76
C5 (P_1×P_6)	IC-281104×IC-090783-3	46.62	1.11	3.14	63.78	1.76	0.54
C_6 (P_1×P_7)	IC-281104×IC-23771	47.13	0.31	-0.95	64.75	-0.55	-0.83
C_7 (P_2×P_3)	IC-021621×IC-127024	44.77	1.89	0.06	63.17	2.03	-1.75
C_8 (P_2×P_4)	IC-021621×IC-090084-2	44.93	0.84	-1.21	62.25	0.11	0.51
C_9 (P_2×P_5)	IC-021621×IC-090084-4	46.62	2.79*	-1.52	63.22	3.70	-0.14
C_{10} (P_2×P_6)	IC-021621×IC-090783-3	43.99	2.43	-1.34	61.05	3.38*	-1.84
C_{11} (P_2×P_7)	IC-021621×IC-23771	45.98	0.28	0.38	63.23	-0.44	-1.82
C_{12} (P_3×P_4)	IC-127024×IC-090084-2	43.35	0.77	-1.51	60.06	1.66	-1.84
C_{13} (P_3×P_5)	IC-127024×IC-090084-4	43.81	1.88	3.59	60.02	1.77	3.51
C_{14} (P_3×P_6)	IC-127024×IC-090783-3	46.43	1.12	0.74	63.32	2.24	-0.44
C_{15} (P_3×P_7)	IC-127024×IC-23771	43.40	0.70	2.22	59.87	1.51	1.77
C_{16} (P_4×P_5)	IC-090084-2×IC-090084-4	44.57	-1.03	0.49	62.34	-0.73	0.40
C_{17} (P_4×P_6)	IC-090084-2×IC-090783-3	43.73	0.41	3.08	60.58	-0.14	0.18
C_{18} (P_4×P_7)	IC-090084-2×IC-23771	43.71	1.99	-1.31	60.94	2.36	-1.77
C_{19} (P_5×P_6)	IC-090084-4×IC-090783-3	43.48	0.65	-1.44	61.33	1.47	-1.38
C_{20} (P_5×P_7)	IC-090084-4×IC-23771	43.68	0.76	-0.25	60.92	-0.74	-1.56
C_{21} (P_6×P_7)	IC-090783-3×IC-23771	43.16	0.50	0.82	60.72	0.47	-1.88
Check 1	Utkarsha	46.07	1.34	-1.31	63.52	2.11	-1.76
Check 2	Chhaya	45.68	0.77	-1.31	63.30	1.01	0.94
Mean		45.12	1.00		62.33	1.00	
SEm±		0.88	0.75		0.87	0.93	
CD (p=0.05)		3.48			3.90		

days) recorded significantly earlier flowering compared with best check Chhaya (45.68 days) with unit regression values (bi=1). Hence, these genotypes are considered to possess the average stability whose performance does not change with the change in environments. The parent P_4 (44.15 days) and C_9 (46.62 days) recorded more than unity (bi>1) and thus possess less than the average stability and is adaptable to favourable environments.

For days to first fruit harvest, all the genotypes recorded non-significant deviation from regression (S^2di=0) values (Table 2). The days to first fruit harvest among the genotypes was ranged from 67.63 (P_1) to 59.32 days (C_3) with an overall mean of 62.33 days. Among the stable hybrids, one hybrid C_3 (59.32 days) with significantly low mean value for days to first fruit harvest compared to best check Chhaya (63.30 days), recorded unit regression coefficient (bi) value and hence possess the average stability and is widely adaptable. The cross C_{10} (61.05 days) and parent P_5 (62.01 days) had low mean value for days to first fruit harvest and recorded regression coefficient of more than one (bi>1) and hence are adapted to favourable environments. These results were consonance with the findings of Sabolu et al., 2014, Shalini, 2016 and Kanakahdani et al., 2021.

Number of days to last fruit harvest among the genotypes varied from 136.14 (P_3) to 151.01 (C_{21}) days with a general mean of 143.20 days (Table 3). Out of 30 genotypes 28 genotypes recorded non-significant deviation from regression (S^2di) values *i.e.*, the genotypes are statistically within the range of minimum deviation from regression and whose performance can be predicted. Among the stable genotypes, four hybrids C_3 (148.59), C_{10} (148.19), C_{16} (149.94) and C_{21} (151.01) and one parent P_1 (149.94 days) with significantly superior to the best check Utkarsha (141.99 days) recorded unit regression coefficient values (bi=1) and hence are adaptable to different environments. Similar results were reported by Rodriguez- Burruezo et al., 2012 and Bhushan and Samnothra, 2017.

Number of marketable fruits per plant ranged from 21.80 (P_7) to 37.06 (C_3) with an overall mean of 30.47. Five hybrids *viz.*, C_3 (37.06), C_5 (34.64), C_{13} (34.23), C_{16} (34.40) and C_{21} (33.94) possessed significantly more number of marketable fruits per plant than the best check Chhaya (31.93) and these are also recorded regression values equal to one. Hence, they are considered to be stable, which can be recommended for wider environments.

The marketable fruit yield per plant of the entries ranged from 1311.00 g (P_3) to 2207.10 g (C_{11}) with an overall mean of 1611.80 g (Table 4). The nonlinear component was significant for two hybrids (C_8 and C_{15}) denoting unpredictable performance of the genotypes over environments. The rest of genotypes registered the non-significant deviation from regression. Among the stable hybrids, five hybrids C_3 (1879.00 g), C_{11} (2207.10 g), C_{13} (1952.70 g), C_{16} (1805.90 g) and C_{21} (2003.40 g) were significantly more yield per plant over the best check Chhaya (1715.00 g). These hybrids were recorded stable performance in wider environments. Parent P_1 (1548.30 g) registered more than one of bi value and hence, is adaptable to favourable environments. The hybrid C_{19} (1652.80 g) exhibited less than one of regression coefficient value and is considered to be adaptable to poor environments. These results were in agreement with the previous observations in brinjal of Vaddoaria et al. (2009 b), Mehta et al. (2011) and Kumar et al. (2017).

The ascorbic acid content among the genotypes ranged from 4.74 mg 100 g^{-1} (P_2) to 10.68 mg 100 g^{-1} (C_4) with an overall mean of 7.21 mg 100 g^{-1} (Table 4). Out of 30 genotypes, 24 genotypes registered the non-significant deviation from regression hence these genotypes performance was predictable. Among the stable hybrids, five hybrids *viz.*, C_2 (8.39), C_4 (10.68), C_{11} (10.35), C_{14} (10.15) and C_{18} (10.41) recorded significantly more ascorbic acid content than the best standard check Utkarsha (7.77 mg 100 g^{-1}) and these were adaptable to wider environments. Similar observation was also made by Mehta et al. (2011) and Stommel et al. (2015) and Tembhurne and Rao, 2013.

The fruit and shoot borer infestation on shoots ranged from 11.67% (C_3) to 16.86% (C_9) with an overall mean of 15.05% (Table 5). Twelve genotypes exhibited significant deviation from regression indicating the preponderance of unpredictable component of G×E interaction. One hybrid C_3 (11.67%) was significantly superior to the best check Chhaya (14.39%) which one also had the unit regression value hence it was suitable for wider environments.

Among the stable genotypes, one parent P_1 (13.29%) and three hybrids *viz.*, C_1 (14.35%), C_{10} (13.86%) and C_{21} (14.16%) showed significantly on par resistance to fruit and shoot borer infestation on shoots along with the best check Chhaya (14.39%) with unit regression values (bi). Hence, these genotypes are considered to possess the average stability whose performance does not change with change in environments. The hybrid C_4 (15.72%) recorded less than unit of bi value and thus possessed more than average stability and is adaptable to poor environments, whereas hybrid C_{11} (15.16%) exhibited more than unit bi value and considered to have less than the average stability and is adaptable to favourable environments. These results were in agreement with the previous observations in brinjal of Kumar et al. (2017) and Koundinya et al. (2019).

Among the genotypes the fruit and shoot borer infestation

Table 3: Stability factors for days to last fruit harvest and number of marketable fruits plant^{-1} in brinjal

Genotypes		Days to last fruit harvest			No. of marketable fruits plant^{-1}		
		μ Mean	bi	S^2di	μ Mean	bi	S^2di
P_1	IC-281104	149.94	1.00	-2.84	32.59	4.84	-0.45
P_2	IC-021621	144.06	1.54	-2.82	28.66	2.69	0.54
P_3	IC-127024	136.14	1.68	-2.57	26.07	0.62	-0.85
P_4	IC-090084-2	140.35	0.40	3.19	32.70	-0.78	1.88
P_5	IC-090084-4	144.35	1.32	-2.11	27.18	1.42	0.06
P_6	IC-090783-3	141.97	-0.04	1.67	27.99	2.66	-0.55
P_7	IC-23771	139.66	1.63	4.08	21.80	2.17	-0.31
C_1 (P_1×P_2)	IC-281104×IC-021621	143.55	0.78	-2.13	29.67	-0.26	-0.40
C_2 (P_1×P_3)	IC-281104×IC-127024	142.41	1.53	-0.72	31.98	-1.71	2.21
C3 (P_1×P_4)	IC-281104×IC-090084-2	148.59	1.02	0.92	37.06	2.43	1.92
C_4 (P_1×P_5)	IC-281104×IC-090084-4	140.65	1.41	-1.82	28.74	1.97	2.62*
C5 (P_1×P_6)	IC-281104×IC-090783-3	142.00	0.55	8.29	34.64	0.56	-0.36
C_6 (P_1×P_7)	IC-281104×IC-23771	144.64	1.39	-2.84	28.22	0.62	0.69
C_7 (P_2×P_3)	IC-021621×IC-127024	144.91	0.80	26.80*	29.34	-0.71	6.05**
C_8 (P_2×P_4)	IC-021621×IC-090084-2	139.75	1.33	-2.71	31.20	2.96	-0.08
C_9 (P_2×P_5)	IC-021621×IC-090084-4	142.63	1.05	-2.77	28.36	1.42	-0.37
C_{10} (P_2×P_6)	IC-021621×IC-090783-3	148.19	0.93	-1.15	31.19	0.22	-0.72
C_{11} (P_2×P_7)	IC-021621×IC-23771	141.27	1.05	11.44*	32.57	1.65	-0.58
C_{12} (P_3×P_4)	IC-127024×IC-090084-2	141.35	1.27	-2.86	29.25	-0.86	0.06
C_{13} (P_3×P_5)	IC-127024×IC-090084-4	142.18	0.86	4.53	34.23	0.30	-0.82
C_{14} (P_3×P_6)	IC-127024×IC-090783-3	144.46	0.96	6.45	29.32	1.13	0.14
C_{15} (P_3×P_7)	IC-127024×IC-23771	139.51	1.25	-2.16	28.64	-0.39	0.43
C_{16} (P_4×P_5)	IC-090084-2×IC-090084-4	149.94	1.02	-2.48	34.40	1.07	-0.11
C_{17} (P_4×P_6)	IC-090084-2×IC-090783-3	141.50	1.70	2.64	29.75	0.78	0.22
C_{18} (P_4×P_7)	IC-090084-2×IC-23771	141.40	0.72	2.73	29.83	1.64	-0.84
C_{19} (P_5×P_6)	IC-090084-4×IC-090783-3	145.15	0.66	-2.80	31.93	-1.06	-0.69
C_{20} (P_5×P_7)	IC-090084-4×IC-23771	142.95	0.82	-2.46	31.58	1.06	-0.77
C_{21} (P_6×P_7)	IC-090783-3×IC-23771	151.01	-0.17	-1.02	33.94	0.78	0.52
Check 1	Utkarsha	141.99	0.58	-1.70	29.29	0.43	-0.76
Check 2	Chhaya	139.28	0.94	-1.37	31.93	2.39	-0.40
Mean		143.19	1.00		30.47	1.00	
SEm±		1.40	0.50		0.75	1.28	
CD (p=0.05)		4.60			1.59		

on fruits varied from 18.56% (C_3) to 27.23% (P_7) with a general mean of 24.13% (Table 5). Out of 30 genotypes 28 genotypes registered the non-significant deviation from regression hence these genotypes performance was predictable. Among the stable hybrids, four hybrids C_3 (18.56%), C_{11} (20.62%), C_{13} (21.05%) and C_{21} (21.17%) with significantly less fruit and shoot borer infestation on fruits than the best check Chhaya (23.07%) recorded unit regression coefficient values and hence possess the average stability and are widely adaptable. The hybrid C_{20} (22.95%) and parent P_1 (22.22%) displayed significantly on par performance with best check Chhaya (23.07%) and average stability with unit regression values. The hybrids C_{16} (21.46%) and C_{19} (22.62%) with less than one of bi values,

Table 4: Stability factors for marketable yield plant^{-1} and ascorbic acid content in brinjal

Genotypes		Days to last fruit harvest			No. of marketable fruits plant^{-1}		
		µ Mean	bi	S^2di	µ Mean	bi	S^2di
P_1	IC-281104	1548.30	2.11*	-2471.29	7.04	2.05	-0.02
P_2	IC-021621	1617.70	1.52	306.63	4.74	0.40	-0.02
P_3	IC-127024	1311.00	0.87	2618.46	6.67	0.24	-0.02
P_4	IC-090084-2	1499.00	0.37	-423.13	6.62	0.63	-0.02
P_5	IC-090084-4	1312.50	1.73	519.22	5.40	-0.10	0.04
P_6	IC-090783-3	1481.20	1.63	-2063.62	6.63	-0.03	0.13*
P_7	IC-23771	1446.00	1.41	307.88	5.91	1.08	-0.02
C_1 (P_1×P_2)	IC-281104×IC-021621	1488.10	0.31	164.18	7.43	0.91	-0.02
C_2 (P_1×P_3)	IC-281104×IC-127024	1564.40	0.36	6951.10	8.39	0.65	0.04
C3 (P_1×P_4)	IC-281104×IC-090084-2	1879.00	0.19	5043.62	6.45	0.61	0.10*
C_4 (P_1×P_5)	IC-281104×IC-090084-4	1382.20	1.54	6849.47	10.68	0.26	0.00
C5 (P_1×P_6)	IC-281104×IC-090783-3	1754.00	0.36	3377.75	4.93	1.76	-0.02
C_6 (P_1×P_7)	IC-281104×IC-23771	1539.60	0.19	700.23	8.23	0.84	-0.02
C_7 (P_2×P_3)	IC-021621×IC-127024	1623.60	0.06	5220.49	6.09	0.53	0.00
C_8 (P_2×P_4)	IC-021621×IC-090084-2	1583.20	2.41	20993.57*	7.10	2.06	-0.02
C_9 (P_2×P_5)	IC-021621×IC-090084-4	1545.30	1.47	138.43	7.39	1.87	0.07
C_{10} (P_2×P_6)	IC-021621×IC-090783-3	1652.10	0.31	1253.78	7.85	1.74	0.00
C_{11} (P_2×P_7)	IC-021621×IC-23771	2207.10	0.92	-1928.81	10.35	1.82	-0.01
C_{12} (P_3×P_4)	IC-127024×IC-090084-2	1499.30	0.71	795.40	5.94	1.58	0.03
C_{13} (P_3×P_5)	IC-127024×IC-090084-4	1952.70	0.80	-2514.61	7.11	0.86	0.49*
C_{14} (P_3×P_6)	IC-127024×IC-090783-3	1490.20	2.19	1868.97	10.15	0.93	-0.02
C_{15} (P_3×P_7)	IC-127024×IC-23771	1547.20	0.57	16559.67*	6.30	0.85	0.08
C_{16} (P_4×P_5)	IC-090084-2×IC-090084-4	1805.90	0.95	-2478.05	4.97	2.29	0.03
C_{17} (P_4×P_6)	IC-090084-2×IC-090783-3	1559.10	0.74	-425.34	8.34	0.21	0.13*
C_{18} (P_4×P_7)	IC-090084-2×IC-23771	1555.60	0.72	-1338.38	10.41	-0.02	-0.02
C_{19} (P_5×P_6)	IC-090084-4×IC-090783-3	1652.80	0.02*	-2507.14	7.77	2.94	0.63*
C_{20} (P_5×P_7)	IC-090084-4×IC-23771	1732.70	1.04	-2458.59	8.00	0.73	0.42*
C_{21} (P_6×P_7)	IC-090783-3×IC-23771	2003.40	1.58	5238.73	5.37	0.96	-0.02
Check 1	Utkarsha	1404.90	1.18	-1613.88	7.77	0.63	0.00
Check 2	Chhaya	1715.00	1.76	963.07	6.17	0.75	-0.01
Mean		1611.80	1.00		7.21	1.00	
SEm±		47.50	0.70		0.21	0.80	
CD (p=0.05)		89.69			0.48		

possess more than average stability and are adaptable to poor environments.

Considering the stability for yield and quality concurrently, C_3, C_{11}, C_{13} and C_{21} were found most promising to an extent under specific environments and can be recommended for general cultivation under Telangana state (Table 6). The results are in consonance with the findings of Bhushan and Samnotra, 2017, Kumari et al. (2020) who also reported higher fruit yield during *kharif-rabi* seasons as compared to *summer* season.

Table 5: Stability factors for fruit and shoot borer infestation on shoots and fruit and shoot borer infestation on fruits in brinjal

Genotypes		Fruit and shoot borer infestation on shoots (%)			Fruit and shoot borer infestation on fruits (%)		
		µ Mean	bi	S^2di	µ Mean	bi	S^2di
P_1	IC-281104	13.29	1.01	-0.26	22.22	1.50	-1.03
P_2	IC-021621	14.97	-0.05	1.38*	24.85	0.62	-0.04
P_3	IC-127024	15.95	-0.84	0.54	26.58	0.49	-0.31
P_4	IC-090084-2	16.04	-0.85	-0.21	24.65	-0.23	1.17
P_5	IC-090084-4	16.55	0.55	-0.23	27.09	1.39	-0.64
P_6	IC-090783-3	15.55	2.11	0.44	26.62	1.72	1.23
P_7	IC-23771	15.90	0.84	0.40	27.23	-1.55	7.37*
C_1 (P_1×P_2)	IC-281104×IC-021621	14.35	0.64	-0.26	26.21	1.54	1.51
C_2 (P_1×P_3)	IC-281104×IC-127024	15.49	1.37	2.42*	24.29	0.59	-1.01
C3 (P_1×P_4)	IC-281104×IC-090084-2	11.67	0.84	-0.41	18.56	0.83	1.02
C_4 (P_1×P_5)	IC-281104×IC-090084-4	15.72	-0.98*	-0.26	25.36	1.35	5.18*
C5 (P_1×P_6)	IC-281104×IC-090783-3	14.80	0.14	7.97*	23.62	0.71	-0.87
C_6 (P_1×P_7)	IC-281104×IC-23771	15.67	0.20	0.90*	25.23	0.79	-0.22
C_7 (P_2×P_3)	IC-021621×IC-127024	15.86	1.34	-0.23	24.67	0.99	1.27
C_8 (P_2×P_4)	IC-021621×IC-090084-2	15.38	1.90	3.95*	23.55	1.49	-0.73
C_9 (P_2×P_5)	IC-021621×IC-090084-4	16.86	1.48	3.35*	25.28	1.56	-1.05
C_{10} (P_2×P_6)	IC-021621×IC-090783-3	13.86	2.66	-0.21	24.66	1.16	-0.96
C_{11} (P_2×P_7)	IC-021621×IC-23771	15.16	2.00*	-0.26	20.62	2.19	-0.42
C_{12} (P_3×P_4)	IC-127024×IC-090084-2	15.56	0.72	2.08*	24.84	0.75	-1.05
C_{13} (P_3×P_5)	IC-127024×IC-090084-4	14.43	0.37	4.90*	21.05	2.06	0.20
C_{14} (P_3×P_6)	IC-127024×IC-090783-3	15.67	1.34	2.37*	25.00	2.50	-0.99
C_{15} (P_3×P_7)	IC-127024×IC-23771	14.95	1.23	1.40*	25.74	1.77	-0.54
C_{16} (P_4×P_5)	IC-090084-2×IC-090084-4	14.75	1.92	0.30	21.46	0.92*	-1.06
C_{17} (P_4×P_6)	IC-090084-2×IC-090783-3	14.46	1.40	2.44*	25.22	1.39	0.64
C_{18} (P_4×P_7)	IC-090084-2×IC-23771	15.04	0.10	-0.24	25.59	0.95	-0.89
C_{19} (P_5×P_6)	IC-090084-4×IC-090783-3	14.89	2.20	0.06	22.62	-1.21*	-1.03
C_{20} (P_5×P_7)	IC-090084-4×IC-23771	15.29	2.14	0.51	22.95	0.33	-0.87
C_{21} (P_6×P_7)	IC-090783-3×IC-23771	14.16	1.50	1.17*	21.17	0.58	-1.02
Check 1	Utkarsha	14.77	1.25	0.02	23.96	1.20	-0.94
Check 2	Chhaya	14.39	1.50	-0.20	23.07	1.63	0.13
Mean		15.05	1.00		24.13	1.00	
SEm±		0.90	0.85		0.77	0.71	
CD (p=0.05)		1.29			1.75		

Table 6: Stability Response of brinjal genotypes (*Solanum melongena* L.) to various traits

Trait	Stability		
	Adopted to all type of environments	Specifically adopted to favourable environments	Specifically adopted to unfavourable environments
Days to first flowering	C_3, P_6	C_9, P_4	
Days to first fruit harvest	C_3	C_{10}, P_5	
Days to last fruit harvest	C_3, C_{10}, C_{16}, C_{21}, P_1		
Number of marketable fruits plant^{-1}	C_3, C_5, C_{13}, C_{16} and C_{21}		
Marketable fruit yield plant^{-1} (g)	C_3,C_{11}, C_{13}, C_{16} and C_{21}	P_1	C_{19}
Ascorbic acid content (mg 100 g^{-1})	C_2, C_4,C_{11}, C_{14} and C_{18}		
Fruit and shoot borer infestation on shoots (%)	C_3		C_4
Fruit and shoot borer infestation on fruits (%)	C_3, C_{11}, C_{13} and C_{21}		C_{16}, C_{19}

4. CONCLUSION

Based on the performance of yield and yield attributing traits in brinjal, C_3, C_{11}, C_{13} and C_{21} could be identified as the most promising and stable genotypes that could be grown in three seasons. These genotypes may be further utilized in breeding programme for developing stable varieties. Present study outstandingly brought out the fact that advantages of F_1's may not only in the area of increased yield and quality, but also for greater stability in production over three seasons.

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