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Stability parameters in bottle gourd

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Abstract

The investigation was carried out to study the stability parameters for fruit yield and associated characters in bottle gourd. The material comprised of nine parents, 36 F_1 hybrids and one standard check. The environments were created by sowing the crop on the different dates at two different locations. The study revaled the presence of genotypes x environment interactions. The variance due to G x E (linear) was significant for all the traits indicating that major portion of G x E interaction were linear in nature and prediction of these traits was still possible. Based on the individual genotypes of adaptability, it is evident that three parental line and twelve hybrids recorded high mean performance alongwith non-significant deviation from regression. The hybrid Banswara Loca-1 x PSPL recorded below average regression coefficient (bi<1) while hybrid Long White Prolific x IC-92374 and Udaipur Local-1 x IC-92374 recorded above average coefficient indicating their better performance in poor and better environments, respectively. While, the parental line Banswara Local-1, Pusa Naveen and PSPL and nine hybrid showed regression coefficient around unity (bi=1) indicating their stability in varying environments.

Key words: *Stability, bottle gourd, genotypes x environment and hybrids*

Introduction

To identify stable varieties/genotypes over different environments and to breed varieties separately for different regions of predictable environmental conditions, study of genotype x environment interactions was felt essential as a preliminary steps. An ideal crop variety is one that has a high mean yield but a low degree of fluctuations in performance, when grown over diverse environment. Due to high remunerative prices in domestic as well as external market, commercial cultivation of bottle gourd has increased in India. For evolving better and stable varieties for high quality yields, it is necessary to screen the available genotypes over a wide range of agro-climatic conditions for their commercial exploitation or effective utilization in breeding programme. Since, no detailed information is available the investigation could be of great significance to the breeders as well as growers.

Materials and methods

The experimental material for analysis of G x E interaction comprised of nine diverse cultivars originated in different agro-climate of India alongwith their 36 F_1 hybrid (excluding reciprocals) and one standard check (Mahyco variety) of bottle gourd were evaluated under four environments created by sowing the experimental material on two different dates at two different locations. The experiment was conducted in a randomized block design with three replications. Each treatment consisted of a single row of accommodating ten plants. The rows were spaced at 3 m apart and plants at 1 m within the row. Observations were recorded from the randomly selected five plants leaving the border plants. The observations were recorded on days to open first male flower, days to open first female flower, node number to first male flower appearance, node number to first female flower appearance, number of male flowers/plant, number of female flowers/plant, number of branches/plant, vine length, days to first harvest, number of fruits/plant, fruit length, fruit girth, fruit weight and fruit yield/plant. The data were analyzed for stability parameters according to the method suggested by Eberhart and Russel (1966) and important yield characters are discussed in the text.

Results and discussion

The pooled analysis of variance revealed that mean squares due to genotypes were highly significant for all the characters indicating the presence of adequate genetic variability in the experimental material. Significant mean squares due to environment and environment (linear) revealed variable environments for all the characters. Significant G x E interaction for all the traits indicated influence of environmental conditions on the genotypes studied. The variance due to G x E (linear) was significant for all the traits indicating that major portion of G x E interaction were linear in nature and prediction of these traits was still possible. Significant mean squares due to pooled deviation for all the traits indicated that genotypes

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differ considerable with respect to their stability and prediction of these attributes would be difficult (Table 1).

Finlay and Wilkinson (1963) considered linear regression slope as a measure of stability. However, Eberhart and Russel (1966) emphasized the need of considering both linear (bi) non-linear (s^2 d) components of genotype environment interactions in judging the phenotypic stability of a genotype. Later on, Samuel *et al.* (1970) and Paroda and Hayes (1971) advocated that linear regression could simply be regarded as a measure of response of a particular genotype, which infact is dependent largely on number of genotypes included in a particular study, whereas deviations from regression lines (s^2d) were considered as a better measure of stability, genotypes with lowest standard deviation being the most stable *vice versa*.

The mean performance (μi), the regression (bi) and deviation from regression (s^2d) components of G x E interaction are presented in the Table 2. The mean performance for female flower per plant among parental lines ranged from 11.35 (IC- 92353A) to 21.95 (Banswara local-1) while among the hybrids it ranged from 16.39 (Long White Prolific x IC-92353A) to 28.12 (Pusa Naveen x IC-92374) with over all mean of 21.03. One parental line and 14 hybrids recorded high mean performance alongwith non-significant deviation from regression ($s^2di=0$) indicating their better performance in better environments while one hybrid (Long White Prolific x PSPL) recorded below average regression co-efficient indicating better performance in poor environments. However, hybrids like Banswara Local-1 x Pusa Naveen, Banswara Local-1 x IC-92374, Long White Prolific X IC-92374, Pusa Naveen x Raichur Local-1, Pusa Naveen x PSPL, Raichur Local-1 x Udaipur Local-1, Raichur Local-1 x IC-92374, Udaipur Local-1 x PSPL and IC-92374 x PSPL recorded regression coefficient around unity (bi=1).

The mean performance for fruits per plant among parental lines ranged from 3.11 to 8.13 (IC-92374) while among hybrids it ranged from 4.29 to 13.83 (Pusa Naveen x IC-92374) with over all mean of 7.36. The hybrid namely Banswara Local-1 x Udaipur Local-1, Long White Prolific x IC-92374, Pusa Naveen x IC-92353A and Udaipur Local-1 x IC-92374 showed above average regression coefficient (bi>1) indicating their better performance in better environments. While parental line Pusa Naveen and IC-92374 and hybrid Banswara Local-1 x Pusa Naveen, Banswara Local-1 x Raichur Local-1, Long White Prolific x Udaipur Local-1, Pusa Naveen x Raichur Local-1, Pusa Naveen x Udaipur Local-1, Pusa Naveen x PSPL and IC-92374 x IC-42361 showed regression coefficient around unity (bi=1) indicating their stability in varying environments.

The mean performance for fruit yield per plant ranged from 1.49 to 6.93 among the parental lines while among the hybrids it ranged from 3.12 to 10.01 (Banswara Local-1 x IC-92374) with an over all mean of 5.97. Three parental lines (Banswara Local-1, Pusa Naveen and PSPL) and twelve hybrids recorded high mean performance alongwith non-significant deviation from regression. The hybrid Banswara Local-1 x PSPL recorded below average regression coefficient (bi<1) while hybrid Long White Prolific x IC-92374 and Udaipur Local-1 x IC-92374 recorded above average regression coefficient indicating their better performance in poor and better environments, respectively. Parental line Banaswara Local-1, Pusa Naveen and PSPL and hybrids Banswara Local-1 x Raichur Local-1, Long White Prolific x PSPL, Pusa Naveen x Raichur Local-1, Pusa Naveen x Udaipur Local-1, Pusa Naveen x IC-92374, Pusa Naveen x PSPL, Raichur Local-1 x IC-92374, Raichur Local-1 x PSPL and IC-92374 x IC-42361 showed regression coefficient around unity (bi=1) indicating their stability in varying environments. However, most of these crosses were also stable for yield contributing traits. In the present study, it is disappointing that the three crosses viz., Banswara Local-1 x IC-92374, Banswara Local-1 x Pusa Naveen and IC-92374 x PSPL showing significant economic heterosis

Table 1. Pooled analysis of variance for stability parameters of various characters over the environments in bottle gourd

Source	d.f.	Mean squares							
		Days to open first female flower	Node number to first female appearance	Number of female flower appearance	Days to first harvest	Number of fruit per plant	Fruit length	Fruit weight	Total fruit yield per plant
1. Genotype (G)	45	128.04**	30.06**	64.55	196.99**	20.99**	116.73**	513.00**	13.13**
2. Environment (E)	3	364.07**	40.70**	44.48	279.83**	11.43**	0.71**	631.29**	4.95**
3. G×E	135	5.26 ••	1.16 ••	1.96 ••	6.68 ••	0.31 ••	1.05 ••	500.78 ••	0.21 ••
4. G+(G×E)	138	13.16++	2.02++	2.88++	12.62++	0.55++	1.04++	503.62++	0.31++
5. E (Linear)	1	1092.21++	122.10++	133.45+	839.48++	34.29++	2.13++	1893.86++	14.86++
6. G×E (Linear)	45	8.10++	2.05++	3.43++	8.41++	0.56++	1.30++	536.80++	0.32++
7. Pooled deviation	92	3.90 ••	0.69 ••	1.19 ••	5.69 ••	0.17 ••	0.91 ••	472.28 ••	0.15 ••
8. Pooled error	360	0.24	0.12	0.12	0.54	0.04	0.07	159.46	0.03

XX Significant at 1% when tested against GxE
++ Significant at 1% when tested against pooled deviation
•• Significant at 1% when tested against pooled error

Table 2. Estimates of stability parameters for various characters in bottle gourd

S.No.	Entries	Days to first harvest			Number of fruits per plant			Total fruit yield yield per plant		
		μi	bi	S^2di	μi	Bi	S^2di	μi	bi	S^2di
1.	Banswara Local – 1	88.88	1.05	1.31*	6.13	0.47	0.001	6.93	0.46	-0.002
2.	Long White Prolific	99.04	1.72	1.36*	4.80	1.06	-0.003	4.71	0.74	0.13**
3.	Pusa Naveen	87.13	1.12	2.49*	7.47	0.41	0.01	6.80	0.33	-0.02
4.	Raichur Local – 1	99.58	2.53	14.85**	3.97	-0.28	0.08	4.29	-1.09*	0.03
5.	Udaipur Local – 1	95.56	0.70	3.84**	5.07	1.15	0.02	5.58	1.49	0.35**
6.	IC-92353A	104.97	0.92	18.99**	3.12	0.38	-0.02	1.49	0.56	-0.02
7.	IC-92374	88.47	2.46	12.35**	8.13	0.31	0.002	5.17	-0.37**	-0.03
8.	IC-42361	109.27	0.71	4.88**	3.14	0.61	0.14*	2.23	0.78*	-0.03
9.	PSPL	94.17	1.86	8.15**	5.82	0.002	0.03	6.33	-0.19	0.02
10.	Banswara Local – 1 x Long White Prolific	96.28	0.72	6.21**	7.74	0.30	0.78**	7.40	0.09	0.57**
11.	Banswara Local – 1 x Pusa Naveen	82.28	0.38	0.62	9.41	0.24	0.07	9.24	1.23	0.16**
12.	Banswara Local – 1 x Raichur Local – 1	93.30	0.43	4.27**	6.54	1.08	-0.03	6.81	1.68	0.02
13.	Banswara Local – 1 x Udaipur Local – 1	91.20	0.68	6.64**	7.78	2.38**	-0.03	6.81	2.55	0.79**
14.	Banswara Local – 1 x IC 92353A	98.57	1.06	4.15**	5.85	0.52	0.38**	5.05	0.91	0.16**
15.	Banswara Local – 1 x IC 92374	83.36	0.47	-0.06	12.17	0.67	0.66**	10.01	0.71	0.08*
16.	Banswara Local – 1 x IC 42361	102.47	0.64	40.46**	6.01	0.87	0.15*	4.94	0.98	0.09*
17.	Banswara Local – 1 x PSPL	85.35	0.52	0.93	8.67	0.14	0.11*	8.27	-0.06*	-0.02
18.	Long White Prolific x Pusa Naveen	84.91	0.83	3.92**	9.78	1.48	0.65**	6.50	0.87	0.57**
19.	Long White Prolific x Raichur Local – 1	96.82	0.45	28.28**	5.82	1.99	0.22**	4.94	2.51	0.31**
20.	Long White Prolific x Udaipur Local – 1	91.69	1.28	2.89**	8.13	0.83	-0.04	4.94	-1.26	0.13**
21.	Long White Prolific x IC- 92353A	100.18	0.94	0.69	5.54	0.92	0.39**	3.75	1.11	0.33**
22.	Long White Prolific x IC- 92374	85.78	1.48	1.45*	10.04	2.63*	-0.02	7.59	3.07*	0.04
23.	Long White Prolific x IC- 42361	99.10	3.19	9.72**	5.67	1.07	0.56**	5.18	1.29	0.45**
24.	Long White Prolific x PSPL	89.82	0.38*	-0.19	7.20	1.40	-0.01	6.85	0.60	-0.01
25.	Pusa Naveen x Raichur Local – 1	84.64	0.66	0.59	9.68	0.41	0.02	6.57	0.96	0.02
26.	Pusa Naveen x Udaipur Local – 1	84.56	0.98	6.00**	9.52	0.45	-0.03	7.23	0.28	0.003
27.	Pusa Naveen x IC- 92353A	93.70	1.08	3.61**	8.01	1.61*	-0.03	5.29	1.95	0.18**
28.	Pusa Naveen x IC- 92374	81.27	0.29*	-0.14	13.83	2.48	0.09*	8.15	1.67	-0.01
29.	Pusa Naveen x IC- 42361	93.49	1.08	3.59**	8.41	1.86	0.36**	6.54	2.11	0.08*
30.	Pusa Naveen x PSPL	82.95	0.55	2.67**	8.64	0.51	-0.001	8.16	0.44	0.44
31.	Raichur Local – 1 x Udaipur Local – 1	93.09	1.61	4.97	5.85	-0.08	0.004	5.67	5.59**	-0.03
32.	Raichur Local – 1 x IC 92353A	101.29	1.09	0.60	4.54	1.16	0.06	3.13	1.38	0.01
33.	Raichur Local – 1 x IC 92374	87.77	1.07	3.62**	9.08	0.85	-0.03	6.26	0.72	-0.001
34.	Raichur Local – 1 x IC 42361	103.15	0.41	13.33**	4.29	1.62*	-0.03	3.39	1.96*	-0.03
35.	Raichur Local – 1 x PSPL	89.57	0.56	1.90**	8.03	0.04	0.02	6.91	-0.003	-0.005
36.	Udaipur Local – 1 x IC- 92353A	97.98	1.14	5.77**	5.32	0.73	0.00	4.19	1.04	0.003
37.	Udaipur Local – 1 x IC- 92374	84.89	0.48	-0.09	11.14	1.94**	-0.04	7.62	1.55*	-0.03
38.	Udaipur Local – 1 x IC- 42361	97.81	2.67	6.24**	5.80	0.86	0.16**	4.95	0.72	0.02
39.	Udaipur Local – 1 x PSPL	90.71	-0.03*	0.37	8.08	1.22	0.01	6.96	1.02	0.29**
40.	IC- 92353A x IC -92374	88.22	0.19	4.08**	7.89	3.81*	0.20**	4.59	3.30*	0.01
41.	IC- 92353A x IC- 42361	105.87	0.92	0.89	5.57	2.26	0.18**	3.35	2.18	0.004
42.	IC- 92353A x PSPL	90.89	0.50	0.32	7.06	2.64	0.59**	4.49	2.18	0.16
43.	IC- 92374 x IC- 42361	88.07	1.63	0.38	9.62	0.30	0.01	7.56	0.03	0.01
44.	IC- 92374 x PSPL	83.77	1.01	0.25	10.41	0.84	0.26**	8.62	1.57	0.25**
45.	IC- 42361 x PSPL	94.06	0.52	0.03	7.13	-0.02	0.05	5.70	1.57	0.08
46.	Check	89.59	1.05	-0.47	7.17	0.87	-0.03	7.35	1.36	0.16**
	Pm (Xb)	92.51	1.00	5.14	7.37	1.00	0.13	5.97	1.00	0.12
	SE (b)		0.56			0.48			0.68	

for fruit yield/plant and its contributing characters none of the cross was stable in all the environments.

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