International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2019; 7(2): 242-251

Received: 13-01-2019
Accepted: 16-02-2019

Stability analysis in pearl millet (*Pennisetum glaucum* (L.) R. Br.)

HM Katariya, MD Khanpara, Vora Zarna, Rakesh Parmar, JB Patel, GU Kulkarni, LJ Raval, DR Mehta and Rajiv Kumar

HM Katariya
Department of Genetics and Plant Breeding, Junagadh Agricultural University, Junagadh (J. A. U.) Gujarat, India

MD Khanpara
Department of Genetics and Plant Breeding, Junagadh Agricultural University, Junagadh (J. A. U.) Gujarat, India

Vora Zarna
Department of Genetics and Plant Breeding, Junagadh Agricultural University, Junagadh (J. A. U.) Gujarat, India

Rakesh Parmar
Department of Genetics and Plant Breeding, Junagadh Agricultural University, Junagadh (J. A. U.) Gujarat, India

JB Patel
Department of Genetics and Plant Breeding, Junagadh Agricultural University, Junagadh (J. A. U.) Gujarat, India

GU Kulkarni
Department of Genetics and Plant Breeding, Junagadh Agricultural University, Junagadh (J. A. U.) Gujarat, India

LJ Raval
Department of Genetics and Plant Breeding, Junagadh Agricultural University, Junagadh (J. A. U.) Gujarat, India

DR Mehta
Department of Genetics and Plant Breeding, Junagadh Agricultural University, Junagadh (J. A. U.) Gujarat, India

Rajiv Kumar
Department of Genetics and Plant Breeding, Junagadh Agricultural University, Junagadh (J. A. U.) Gujarat, India

Correspondence
HM Katariya
Department of Genetics and Plant Breeding, Junagadh Agricultural University, Junagadh (J. A. U.) Gujarat, India

Abstract
Stability for grain yield performance and genotype x environment (G x E) interaction was studied in 45 genotypes (Nine restorer inbred and their 36 hybrids made by using half diallel mating design) of pearl millet by evaluating them in different environments [Early (3th July), timely (18th July) and late sowing (3 th August)] following randomized block design with three replications during *kharif* 2017 at Sagadividi Farm, Department of Seed Science and Technology, College of Agriculture, Junagadh Agricultural University, Junagadh. One parents J-2482 and Nine Crosses (J-2433 × J-2482, J-2433 × J-2496, J-2433 × J-2508, J-2479 × J-2496, J-2482 × J-2496, J-2482 × J-2507, J-2496 × J-2507, J-2496 × J-2508 and J-2507 × J-2508) expressed their stability across the environments due to their high grain yield per plant, non-significant regression coefficient (b_i) and deviation from linear regression (S^2d_i). The crosses, J-2433 × J-2503, J-2433 × J-2507, J-2479 × J-2482, J-2482 × J-2503, J-2496 × J-2503 and J-2500 × J-2507 were having more grain yield per plant and had the least deviation from linear regression, but had significant regression coefficient (bi >1) and thus, found to be highly responsive to better environments. The stable parents J-2482 were also showed stability for important yield components like ear head girth, total biomass per plant, Fe and Zn content. This indicated that stability of various component traits might be responsible for the observed stability of various hybrids for grain yield per plant. Hence, chances of selection of stable hybrids for yield could be enhanced by selecting for stability for yield components.

Keywords: pearl millet, environment, genotype x environment interaction, stability

Introduction
Pearl millet is an annual, tillering habit, diploid (2n=14) and the most important member of the genus *Pennisetum* belonging to the tribe *Paniceae*, family *Poaceae*. It is commonly known as pearl, cat tail, spiked or bulrush millet in English with taxonomic nomenclature of *Pennisetum glaucum* (L.) R. Br., which is believed to be originated in Africa, Pearl millet is mainly grown in Gujarat, Rajasthan, Uttar Pradesh, Haryana and Maharashtra; which share about 91.87 per cent of total pearl millet production of India. It is grown on about 9.03 million hectare area with an annual production of 6.67 million tones and productivity 730 kg/ha. In Gujarat, the cultivated area of pearl millet including *kharif* and *summer* season is an about 4.54 lakh hectare with production of 10.14 lakh metric tonnes with an average productivity of 2292 kg/ha (Anon., 2017) [2].

Genotype and its interaction with prevailing environment is the basic factor determining the final yield. The genotype x environment interaction is particularly important in the expression of quantitative characters, which are controlled by polygenic systems and are greatly modified by the environmental influences. Thus, in order to have unbiased estimates of various genetic components, it is imperative that the experiment should be repeated over different environments. Crop yield in which the plant breeder is most interested is dependent on the genotype, the environment and the interaction between genotype and environment. The result of the genotype x environment interaction is expressed as adaptability and stability of the genotype. When interaction between genotype and environment exists, ranking of genotype will be different under different environments. The stability of productivity is, therefore, very important. Hence, it is always desirable to study the stability of hybrids in respect of economically important characters. The estimates of genotype x environment interactions give an idea of stability or buffering ability of populations under study. The present investigation was, therefore, planned to measure the genotype x environment interaction and to estimate stability parameters for grain yield and its components in pearl millet.

Materials and Methods

The experimental material comprised of 36 crosses developed from 9 restorer inbred using half diallel mating design. The materials was evaluated in a Randomized Block Design with three replications in three different environments [Early (3rd July), timely (18th July) and late sowing (3 th August)] following randomized block design with three replications during *kharif* 2017 at Sagadividi Farm, Department of Seed Science and Technology, College of Agriculture, Junagadh Agricultural University, Junagadh. Each entry was sown in a single row plot of 5.0 m length keeping row-to-row and plant-to-plant distance of 60 cm and 15 cm, respectively. Five competitive plants per genotype in each replication in each environment were selected randomly for recording observations on different characters *viz*., number of node on main stem, number of effective tillers per plant, plant height (cm), ear head length (cm), ear head girth (cm), green ear head weight (g), dry ear head weight (g), grain yield per plant (g), test weight (g), panical index, total biomass per plant(g), Fe content(ppm), Zn content (ppm), harvest index (%), while observations on days to 50% flowering and days to maturity were recorded on plot basis. The data were analyzed for G x E interactions and stability parameters following the model of Eberhart and Russell (1966) [8].

Results and Discussion

The pooled analysis of variance (Table: 1) revealed that the mean squares due to genotypes were found significant for all the characters studied, when tested against pooled deviation. The mean sum of squares due to environments were found significant for all the characters except days to flowering, days to maturity, number of node on main stem, plant height and dry ear head weight when tested against pooled deviation. G x E interaction was found significant for all the characters studied, except panicle index, Fe content and Zn content when tested against pooled deviation. The mean sum of squares due to environments (linear) were also noted significant difference for all the characters studied when tested against pooled deviation, suggesting that differences between environments were considerable for grain yield per plant and it was influenced greatly by environment indicating thereby that large differences between environments along with the greater part of genotypic response was a linear function of environment. This also indicated that environments created by sowing dates was justified and had linear effects. The coincidence of genotypic performance with environmental values was observed for all the traits studied except days to flowering, number of node on main stem, panicle index, Fe and Zn content, as evident by significant G x E (linear) mean squares when tested against pooled deviation, indicating that performance of genotypes over environments could be predicted reasonably for these significant traits. Mean sum of squares due to pooled deviation were significant for all the characters, expect panicle index, Fe content, Zn content and harvest index, which suggested that prediction of performance of genotypes over environments based on regression analysis for these traits might not be very reliable.

The stability of performance is one of the most desired characters of a genotype for wider adaptation. The stability parameters *viz*., mean performance (Xi), regression coefficient (bi) and deviation from linear regression (S^2di) for parents as well as hybrids were estimated for fourteen characters to assess the relative phenotypic stability of performance over environments.

Recently, interest has been focused on regression analysis. The regression approach was first proposed by Yates and Cochran (1938) [28] which was later modified by Finlay and Wilkinson (1963) [9] to interpret the varietal adaption to varying environments. Regression technique was slightly improved by adding one more parameters i.e. deviation from regression by Eberhart and Russell (1966) [8]. According to them, both linear (bi) and non-linear (S^2di) function should be considered while judging the phenotypic stability of genotype. Eberhart and Russell (1966) [8] defined a stable genotype as one which produces high mean yield, depicts regression coefficient.

It is always justified to breed for genotypes with only high yield potential because of the times the yield potential cannot be expressed. Therefore, a much higher priority should be given to improve yield stability (Ceccarelli, 1989) [4] Stability is genetically controlled characters (Bradshaw, 1965 and Scott, 1967 therefore, one can breed also for stability. Stability for yield may be dependent upon stability of different yield components. Hence, information on the relative stability for different yield components is essential to understand diverse mechanism contributing to yield stability.

Stability in performance is one of the most desirable properties of a genotype for its wide adaptability. The stability parameters *viz*., mean performance (Xi) across the environments, regression coefficient (bi) and deviation from linear regression (S^2di) for parents and hybrids were estimated as per Eberhart and Russell (1966) [8] for 16 characters to assess the relative stability of genotypes over environments and are presented in (Table 2 to 7). The perusal of stability parameters for grain yield per plant and other 15 characters revealed that none of genotypes was stable for all the characters which indicated that any generalization pertaining to stability of genotypes for all the traits was not possible. For grain yield per plant, one parents J-2482 and nine Crosses (J-2433 × J-2482, J-2433 × J-2496, J-2433 × J-2508, J-2479 × J-2496, J-2482 × J-2496, J-2482 × J-2507, J-2496 × J-2507, J-2496 × J-2508 and J-2507 × J-2508) expressed their stability across the environments due to their high grain yield per plant, non-significant regression coefficient (b_i) and deviation from linear regression (S^2d_i). The crosses, J-2433 × J-2503, J-2433 × J-2507, J-2479 × J-2482, J-2482 × J-2503, J-2496 × J-2503 and J-2500 × J-2507 were having more grain yield per plant and had the least deviation from linear regression, but had significant regression coefficient (bi >1) and thus, found to be highly responsive to better environments. while J-2482 × J-2500 and J-2503 × J-2507 had more grain yield per plant with non-significant deviation from regression, but had significant regression coefficient (b_i<1) showed above average response and high stability under unfavourable environments. The performance of J-2433 × J-2479 and J-2433 × J-2510 could not be predicted due to significant deviation from linear regression (S^2di) for grain yield per plant.

In general, parents found stable for grain yield per plant also depicted their stability of performance across the environments for one or more yield attributing traits. The highest yielding stable parent, J-2482 (30.65 g) was found to be stable for ear head girth, total biomass per plant, Fe and Zn content. J-2482 was one of the parents of the three stable hybrids (J-2433 × J-2482, J-2482 × J-2496, J-2482 × J-2507) for grain yield per plant. Its utilization in hybrid breeding would be useful in improvement of R-line breeding.

The nine stable hybrids for grain yield per plant are listed in (Table: 8) along with their grain yield per plant and various component traits for which they showed stability. The perusal of the data revealed that the best three stable hybrids for grain yield per plant were J-2433 × J-2482 (36.40 g), J-2482 × J-2496 (35.23 g) and J-2482 × J-2507 (34.46 g). Among these, first ranked stable hybrid, J-2433 × J-2482 was found to be stable for number of nodes on main stem, plant height, ear head length, ear head girth, harvest index, Zn content. It also showed stability under favourable environment for number of effective tillers per plant, green ear head weight, dry ear head weight, total biomass per plant, Fe content. This hybrid ranked first with respect to grain yield per plant and had high and significant positive sca effect as well as significant heterosis over better parent in E_1 and E_2 environments, while significant standard check, GHB-558 in all three environments. The second ranked stable hybrid, J-2482 × J-2496 was found to be stable for number of nodes on main stem and green ear head weight. It was also highly responsive to favourable environments for number of effective tillers per plant, plant height, ear head length, ear head girth, dry ear head weight, total biomass per plant, harvest index and Fe and Zn content. This hybrid ranked second in *per se* performance and high and significant positive sca effect as well as had significant heterosis over better parent as well as standard check, GHB-558. The third ranked stable hybrid J-2482 × J-2507 was found to be stable for days to 50% flowering, days to maturity, ear head length and ear head girth. It was also highly responsive to favourable environments for green ear head weight, dry ear head weight, total biomass per plant and harvest index. This hybrid ranked third in *per se* performance and had high and significant positive sca as well as had significant heterosis over better parent as well as standard check. Several research workers have also reported stability parameters for grain yeid and its componets *viz*., Singh and Gupta (1978) [22], Chaudhary *et al.* (1981) [5], Gupta *et al.* (1983) [11], Pethani and Kapoor (1985) [17], Gupta and Ndoye (1991) [12], Suryavanshi *et al.* (1991) [24], Chavan and Nerkar (1994) [6] Karale *et al.* (1997) [14], Yadav *et al.* (1997) [27] Prajapati *et al.* (1998) [18], Monyo *et al.* (2000) [16], Anarase *et al.* (2001) [1] Hanif *et al.* (2001) [13], Raiger and Prabhakaran (2001) [19], Shindhe *et al.* (2002), Chikurte *et al.* (2003) [7], Kumar and Sahib (2003) [15], Umaretiya (2006) [25], Wedajo (2014) [26] and Singh and Singh (2016) [23].

In general, most of the hybrids identified as stable for grain yield per plant also showed stability for one or more component traits like days to 50% flowering, days to maturity, number of nodes on main stem, number of effective tillers per plant, plant height, ear head length, ear head girth, green ear head weight, dry ear head weight, total biomass per plant, Zn content and harvest index. This indicated that stability of various component traits might be responsible for the observed stability of various hybrids for grain yield per plant. Hence, chances of selection of stable hybrids for yield could be enhanced by selecting for stability for yield components. Grafius (1959) [10] also observed that stability of grain yield might be due to the stability of various yield components.

Component traits might be responsible for the observed stability of various hybrids for grain yield per plant. Hence, chances of selection of stable hybrids for yield could be enhanced by selecting for stability for yield components. Grafius (1959) [10] also observed that stability of grain yield might be due to the stability of various yield components.

The stability parameters for component traits revealed that none of the parents and hybrids (genotypes) was stable for all the traits. The stability parameters for component traits revealed that 11 and 12 genotypes turned out to be stable each for days to flowering and days to maturity, respectively with low mean values (negative values were considered desirable for these traits), non-significant regression coefficient and deviations from linear regression. As many as 14, 02, 09, 11, 05, 09, 10 genotypes were found to be stable for number of nodes on main stem, number of effective tillers per plant, plant height, ear head length, ear head girth, green ear head weight and dry ear head weight, respectively with high mean, non-significant regression coefficient and deviations from linear regression. Total of 03, 05, 10, 13, 04 and 11 genotypes turned out to be stable across the environments for 1000 grain weight, panicle index, total biomass per plant, harvest index, Fe content and Zn content, respectively by recording high mean values for these traits with non-significant regression coefficient and deviations from linear regression.

Traits wise result of genotypes showing specific adaptation to favourable (better management condition) and unfavourable (poor management condition) environments revealed that 5 and 1 genotypes for days to flowering, 6 and 2 genotypes for days to maturity, 3 and 0 genotypes for number of nodes on main stem, 7 and 2 genotypes for number of effective tillers per plant, 8 and 2 genotypes for plant height, 6 and 0 genotypes for ear head length, 5 and 3 genotypes for ear head girth, 6 and 1 genotypes for green ear head weight, 6 and 3 genotypes for dry ear head weight, 6 and 2 genotypes for grain yield per plant, 7 and 4 genotypes for 1000 grain weight, 3 and 1 genotypes for panicle index, and 12 and 3 genotypes for total biomass per plant, 9 and 2 genotypes for harvest index, 15 and 0 genotypes for Fe content and 10 and 1 genotypes for Zn content, were found to be highly responsive to favourable and unfavourable environments, respectively.

The potential yield of each genotype can be realized under a particular set of agronomical practices. Hence, it is suggested that in order to identify stable genotypes, actual testing under variable environments including favourable and unfavourable would be advantageous. During selection, the attention should be paid to the phenotypic stability of characters directly related to grain yield per plant *viz*., number of effective tillers per plant, ear head length, ear head girth, green ear head weight, dry ear head weight, grain yield per plant and 1000 grain weight in pearl millet.

Conclusion

From the foregoing discussion, it is clear that, parent J-2482 was found to be stable for grain yield per plant and some of the important yield components should be given due importance while formulating breeding programme aiming to develop high yielding and stable hybrids in pearl millet. The best stable cross combinations for seed yied per plant and important yield components J-2433 × J-2482, J-2482 × J-2496 and J-2482 × J-2507 Thus, is due importance to be content to be given to this parent while formulating R- line breeding programme aiming to develop high yielding and stable hybrids in pearl millet.

Table 1: Analysis of variance (m.s.s.) for phenotypic stability for different characters in pearl millet

Sources of variation	d.f.	Characters							
		Days to 50% Flowering	Days to Maturity	Number of nodes on main stem	Number of effective tillers per plant	Plant height (cm)	Ear head length (cm)	Ear head girth (cm)	Green ear head weight (g)
Environments	2	7.05	6.76	0.46	0.29**	156.22	12.42*	1.03*	620.27**
Genotypes	45	12.49**	13.69**	1.97**	0.23**	511.80**	28.49**	3.27**	200.86**
Genotype x Environment	90	3.30**	3.43**	0.21**	0.06**	92.07**	2.76**	0.30**	38.66**
Environments (linear)	1	14.09**	13.53**	0.91**	0.59**	312.44**	24.85**	2.07**	1240.54**
Genotype x Environment (linear)	45	2.47	4.23**	0.15	0.06**	130.34**	2.22*	0.39**	44.11**
Pooled deviation	46	4.03**	2.58*	0.28**	0.05**	52.63**	3.23**	0.21**	32.50**
Pooled error	270	1.79	1.75	0.09	0.01	20.99	1.31	0.08	16.92

Table 1: Contd…..

Sources of variation	d.f.	Characters							
		Dry ear head weight (g)	Grain yield per plant (g)	1000 grain weight (g)	Panicle index (%)	Total biomass per plant (g)	Fe Content (ppm)	Zn Content (ppm)	Harvest index (%)
Environments	2	42.33	61.02**	1.61*	1020.97**	93.87*	187.46**	105.71**	37.86**
Genotypes	45	76.62**	34.72**	1.76**	71.93**	213.71**	397.45**	43.33**	21.41**
Genotype x Environment	90	14.27**	6.25**	0.41**	18.02	28.79**	11.54	5.23	3.50*
Environments (linear)	1	84.66**	122.04**	3.23**	2041.95**	187.74**	374.93**	211.41**	75.71**
Genotype x Environment (linear)	45	14.58**	6.01*	0.46**	19.29	35.06**	14.49	3.62	4.83*
Pooled deviation	46	13.66**	6.36**	0.35**	16.39	22.03*	8.42	6.68	2.12
Pooled error	270	6.18	3.07	0.14	16.24	15.45	18.01	9.19	2.59

* and ** significant at 5 and 1 per cent level probability, respectively.

Table 2: Stability parameters of different genotypes for days to 50 per cent flowering, days to maturity and number of nodes on main stem in pearl millet

Sr. No.	Genotypes	Days to 50 per cent flowering			Days to maturity			Number of nodes on main stem		
		Mean	b_i	S^2d_i	Mean	b_i	S^2d_i	Mean	b_i	S^2d_i
	Parents									
1.	J- 2433	48.69	1.59	-1.56	80.05	-0.40	-1.71	7.05	-1.93	-0.02
2.	J-2479	44.97	1.31	-0.91	76.78	0.77	0.59	6.85	1.83	-0.06
3.	J-2482	47.60	-1.75	-0.40	78.53	1.91	1.53	5.13	-1.24	0.33*
4.	J-2496	45.65	1.29	4.78	76.25	-2.47	-1.20	5.55	1.77	-0.04
5.	J-2500	46.92	5.54	1.09	77.52	6.23	1.96	5.93	-1.22	0.23
6.	J-2503	45.69	-0.79	5.67*	75.98	7.84*	1.31	6.32	-1.23	-0.03
7.	J-2507	43.02	-0.37	0.51	74.15	0.20	-1.74	4.94	-2.58	0.47*
8.	J-2508	41.42	1.7	7.92*	72.99	1.12	-1.62	4.94	-7.08*	0.12
9.	J-2510	42.85	3.27**	-1.73	72.97	0.95	-1.29	6.04	0.70	0.25
	Crosses									
10.	J-2433 × J-2479	47.33	-2.71	0.97	78.26	-3.41	0.82	7.65	-0.41	-0.04
11.	J-2433 × J-2482	45.24	-0.10	1.22	78.53	-2.79+	-0.85	7.41	0.75	0.00
12.	J-2433× J-2496	45.67	-0.11	4.77	76.60	-4.3**	-1.75	6.57	6.28*	0.09
13.	J-2433× J-2500	45.56	3.17**	-1.75	76.49	1.45	-0.60	6.41	5.69	0.27*
14.	J-2433× J-2503	46.34	3.64	16.40**	77.27	8.81**	-1.67	7.57	-0.10	-0.04
15.	J-2433× J-2507	43.36	7.93**	-1.60	74.30	1.53	12.58**	6.66	1.79	0.03
16.	J-2433× J-2508	44.13	-1.95	0.53	75.06	-2.97	-0.25	6.27	3.93	0.25
17.	J-2433× J-2510	45.30	5.00**	-1.75	77.32	4.56	16.78**	5.55	0.96	0.60**
18.	J-2479× J-2482	43.52	5.69	4.33	74.46	-2.67	7.86*	7.14	1.78	0.08
19.	J-2479× J-2496	44.61	-0.39**	-1.79	75.54	0.27	-1.11	6.72	0.70	0.03
20.	J-2479× J-2500	42.05	1.73	10.99**	72.98	-5.66*	-0.15	7.07	6.73	1.28**
21.	J-2479× J-2503	42.69	3.74**	-1.76	73.62	1.54	0.16	5.83	-2.56	0.52*
22.	J-2479× J-2507	44.79	0.99	-0.06	75.72	-1.83**	-1.66	5.84	1.72	0.34*

Table 2: Contd…..

Sr. No.	Genotypes	Days to 50 per cent flowering			Days to maturity			Number of nodes on main stem		
		Mean	b_i	S^2d_i	Mean	b_i	S^2d_i	Mean	b_i	S^2d_i
23.	J-2479× J-2508	40.60	-3.09	10.27*	72.50	1.26	7.38*	6.32	4.11	0.20
24.	J-2479× J-2510	43.76	-2.95	1.30	74.69	-3.64	1.16	5.80	1.42	0.31*
25.	J-2482× J-2496	43.92	1.69	3.27	74.85	-3.31*	-0.93	7.70	3.61	0.12
26.	J-2482× J-2500	42.51	-2.96	11.96**	73.44	-7.12**	-0.28	4.84	1.89**	-0.08
27.	J-2482× J-2503	42.02	6.90	12.63**	72.95	8.82*	2.88	5.77	-0.68	-0.07
28.	J-2482× J-2507	41.98	-0.21	1.41	72.91	3.40	-0.44	4.54	1.71	0.37*
29.	J-2482× J-2508	43.86	0.87	1.20	74.79	3.57**	-1.45	5.12	-1.72	-0.05
30.	J-2482× J-2510	43.27	2.26	3.53	74.20	-3.27	-0.25	5.27	1.90*	-0.07
31.	J-2496× J-2500	40.85	-0.42	-1.50	71.45	2.61	-0.81	6.37	1.86	-0.04
32.	J-2496× J-2503	44.29	3.58	4.50	74.89	-1.78	2.05	5.40	1.79	0.02
33.	J-2496× J-2507	45.75	-6.61	1.67	75.84	2.28	10.55**	6.23	0.74*	-0.09
34.	J-2496× J-2508	40.35	-2.15**	-1.73	71.21	2.27	-0.11	5.04	2.01	0.27*
35.	J-2496× J-2510	41.13	1.78	3.31	71.73	-1.80	-0.89	5.53	0.73	-0.05
36.	J-2500× J-2503	42.12	-1.14	3.22	72.72	5.46	1.44	5.68	1.67	0.65**
37.	J-2500× J-2507	42.10	-0.64	-1.25	72.70	0.27	-1.17	6.34	1.97	0.09
38.	J-2500× J-2508	45.01	2.22	0.19	75.61	-0.17	-0.86	6.91	1.73	0.27*
39.	J-2500× J-2510	42.89	2.39	-1.08	73.49	3.89**	-1.54	6.03	2.04	0.40*
40.	J-2503× J-2507	44.07	2.16	7.29*	74.67	7.70**	-1.71	7.17	5.26**	-0.07
41.	J-2503× J-2508	40.88	-0.05	-0.39	71.48	3.86*	-0.88	5.92	2.81**	-0.09
42.	J-2503× J-2510	43.19	0.52	4.14	73.79	6.24**	-0.86	6.35	0.40	0.34*
43.	J-2507× J-2508	43.73	-2.28**	-1.76	74.33	1.48	1.74	5.96	1.81	-0.03
44.	J-2507× J-2510	41.13	2.27**	-1.74	71.73	2.77**	-1.44	5.18	-6.77	0.94**
45.	J-2508× J-2510	40.31	1.15**	-1.78	71.64	-1.0**	-1.75	5.24	-1.57	0.23
	Mean	**43.68**	-	-	**74.63**	-	-	**6.08**	-	-

*, ** Indicates significance at P = 0.05 and P = 0.01 levels, respectively

Table 3: Stability parameters of different genotypes for plant height (cm), number of effective tillers per plant and ear head length in pearl millet

Sr. No.	Genotypes	Number of effective tillers per plant			Plant height (cm)			Ear head length (cm)		
		Mean	b_i	S^2d_i	Mean	b_i	S^2d_i	Mean	b_i	S^2d_i
	Parents									
1.	J- 2433	1.60	0.87*	-0.01	160.20	3.61	86.18*	19.80	-0.62	2.40
2.	J-2479	1.54	0.23	0.02	153.06	-0.08	66.68*	18.54	-2.57	1.19
3.	J-2482	1.43	1.57**	-0.01	141.26	2.05	-11.71	17.66	1.80**	-1.06
4.	J-2496	1.35	1.53**	-0.01	145.45	-4.29*	-1.64	15.34	1.75*	-0.95
5.	J-2500	1.58	1.99	0.00	143.27	-2.23**	-20.36	16.19	-1.83	1.48
6.	J-2503	1.60	0.74*	-0.01	142.77	-0.13	-17.93	15.76	1.93**	-1.26
7.	J-2507	1.43	-0.29	-0.01	132.13	-5.94	103.64*	14.94	2.38*	-0.72
8.	J-2508	1.40	-1.34	0.03*	126.72	2.53	6.80	14.71	-1.73*	-0.98
9.	J-2510	1.33	-0.63	-0.00	138.41	4.35	47.50	16.32	-4.02	2.72
	Crosses									
10.	J-2433 × J-2479	2.18	5.06**	-0.00	172.55	1.84*	-15.99	22.71	5.66**	1.12
11.	J-2433 × J-2482	1.95	2.95**	-0.01	167.73	-1.40	6.77	24.85	0.05	-0.54
12.	J-2433× J-2496	2.06	2.87**	-0.01	164.33	2.27	41.58	25.70	4.34**	-1.22
13.	J-2433× J-2500	2.16	8.29**	-0.002	170.51	7.73**	-10.32	20.89	-0.19	6.14*
14.	J-2433× J-2503	2.40	-4.51	0.28**	176.28	-3.28**	-17.71	19.73	1.43	2.86
15.	J-2433× J-2507	1.86	1.26**	-0.01	161.98	4.97**	-3.46	17.18	1.33	4.20*
16.	J-2433× J-2508	1.48	1.93**	-0.01	162.51	0.78	-10.00	14.76	0.91**	-1.25
17.	J-2433× J-2510	1.39	1.44**	-0.01	145.06	2.55	53.82	15.90	2.43**	-1.20
18.	J-2479× J-2482	1.99	0.19	-0.01	167.35	0.31	10.45	22.00	1.48	0.11
19.	J-2479× J-2496	1.71	-0.08	0.03	172.44	1.12	6.63	22.23	-2.31	5.30*
20.	J-2479× J-2500	2.08	4.06**	-0.01	163.55	10.76**	-20.98	21.62	2.89**	-1.18
21.	J-2479× J-2503	1.57	-0.39	-0.01	140.54	-10.224**++	30.90	23.23	2.37**	-1.30
22.	J-2479× J-2507	2.08	-0.60	0.43**	150.08	10.39**	-10.06	15.11	2.00**	-1.30
Sr. No.	**Genotypes**	**Number of effective tillers per plant**			**Plant height (cm)**			**Ear head length (cm)**		
		Mean	b_i	S^2d_i	**Mean**	b_i	S^2d_i	**Mean**	b_i	S^2d_i
23.	J-2479× J-2508	1.48	0.56	0.00	154.41	3.19	299.41**	21.17	1.25	1.52
24.	J-2479× J-2510	1.83	-1.88	0.13**	141.47	1.68**	-20.91	16.11	1.49	5.32*
25.	J-2482× J-2496	1.70	2.99**	-0.01	172.36	5.88**	-20.96	21.09	2.00**	-1.30
26.	J-2482× J-2500	2.08	6.53	0.17**	153.20	-3.55	28.39	23.11	1.99**	-1.30
27.	J-2482× J-2503	2.10	0.38	0.13**	148.11	-3.88	195.48**	23.07	-2.22	-0.07
28.	J-2482× J-2507	1.30	0.24	-0.00	144.23	2.96	49.03	16.47	2.63	0.45
29.	J-2482× J-2508	1.71	2.84	0.03*	144.71	-0.43	-18.50	18.39	2.55**	-1.20
30.	J-2482× J-2510	1.59	1.02	0.03*	135.28	2.5	32.46	15.16	-2.86	4.94*
31.	J-2496× J-2500	1.84	3.23	0.11**	150.68	4.08*	5.82	20.66	-1.09	5.03*
32.	J-2496× J-2503	1.67	-0.48	0.08**	148.74	-2.6	23.06	20.59	2.53	-0.11

33.	**J-2496× J-2507**	1.39	1.40*	-0.01	156.45	1.37	-11.81	16.66	2.84	1.81
34.	**J-2496× J-2508**	1.34	-1.63	-0.00	131.22	0.38	50.19	19.25	1.17	2.17
35.	**J-2496× J-2510**	1.60	-1.53	0.00	142.56	-2.35	13.39	14.73	-0.99	1.54
36.	**J-2500× J-2503**	1.75	3.26	0.03*	154.48	0.92	17.16	20.24	-0.26	10.38**
37.	**J-2500× J-2507**	1.70	-1.12*	-0.01	139.38	2.2	112.77*	21.59	0.84	1.43
38.	**J-2500× J-2508**	2.01	-0.66**	-0.01	153.05	6.97**	-11.59	15.25	2.00**	-1.30
39.	**J-2500× J-2510**	1.56	0.62	0.01	128.54	4.06	38.91	14.33	-0.25	7.23*
40.	**J-2503× J-2507**	1.70	2.93	0.07**	161.46	4.42**	-20.05	18.07	1.13	2.52
41.	**J-2503× J-2508**	1.45	-0.51	0.10**	156.30	-8.84**	15.29	18.08	4.54	28.72**
42.	**J-2503× J-2510**	1.38	0.23	-0.01	139.84	-2.59	323.23**	14.83	0.74	6.54*
43.	**J-2507× J-2508**	1.49	0.50	0.06*	157.63	-0.16	54.88	19.73	1.56	-0.25
44.	**J-2507× J-2510**	1.41	-0.64	0.03*	135.69	-5.47*	16.04	17.47	1.99**	-1.30
45.	**J-2508× J-2510**	1.53	0.44	0.12**	133.50	6.03**	-16.94	19.29	2.86	1.99
Mean		**1.68**	-	-	**150.47**	-	-	**18.66**	-	-

*, ** Indicates significance at P = 0.05 and P = 0.01 levels, respectively

Table 4: Stability parameters of different genotypes for ear head girth, green ear head weight and dry ear head weight in Pearl millet

Sr. No.	Genotypes	Ear head girth (cm)			Green ear head weight (g)			Dry ear head weight (g)		
		Mean	b_i	S^2d_i	**Mean**	b_i	S^2d_i	**Mean**	b_i	S^2d_i
					Parents					
1.	**J- 2433**	8.43	3.18	0.44*	76.37	0.36	-6.63	50.82	-2.92*	-2.53
2.	**J-2479**	8.40	-8.62**	0.08	72.34	0.07	81.43*	48.02	3.02	14.59
3.	**J-2482**	8.50	2.18	0.19	78.48	-1.31**	-12.98	50.31	-4.12**	-1.80
4.	**J-2496**	6.50	3.25	0.17	65.21	-0.80++	-5.18	42.26	-2.30	10.52
5.	**J-2500**	5.92	4.09*	0.09	57.65	1.49	7.15	39.32	1.24	-3.82
6.	**J-2503**	6.92	3.09**	-0.05	58.06	-1.04**	-16.76	37.79	-0.86	-1.12
7.	**J-2507**	6.52	0.24	-0.05	68.95	1.73*	-2.92	44.61	3.14**	-4.69
8.	**J-2508**	6.60	0.80	0.04	65.41	0.39+	-15.01	42.34	-0.61**	-6.08
9.	**J-2510**	5.53	-0.09	0.21	56.55	-0.19	37.98	37.23	-0.17	33.50*
					Crosses					
10.	**J-2433 × J-2479**	9.39	5.66**	0.07	84.44	2.34**	-16.76	54.53	4.02**	-2.16
11.	**J-2433 × J-2482**	8.31	-0.65	-0.07	86.15	2.39**	-1.84	54.55	3.97**	-4.36
12.	**J-2433× J-2496**	8.55	2.28	0.40*	73.59	2.59**	3.42	47.44	5.07**	-5.27
13.	**J-2433× J-2500**	7.50	1.18**	-0.08	69.24	1.18	-4.12	44.67	0.66	-0.03
14.	**J-2433× J-2503**	9.21	5.90**	-0.03	80.36	1.25	20.25	51.87	2.45	4.13
15.	**J-2433× J-2507**	8.49	1.84	0.06	83.61	0.89**	-14.79	53.91	0.76	-5.25
16.	**J-2433× J-2508**	8.81	3.92	1.03**	74.63	2.57**	-0.26	48.13	4.88**	-5.95
17.	**J-2433× J-2510**	7.37	-3.75	0.57**	76.75	-0.49	-12.61	49.45	-2.06	3.35
18.	**J-2479× J-2482**	8.87	-5.93**	-0.07	79.51	0.59	83.37*	51.35	1.68	34.98*
19.	**J-2479× J-2496**	8.77	3.92	0.18	77.64	0.78	-9.38	50.40	0.28	-3.01
20.	**J-2479× J-2500**	8.50	-4.70**	0.07	70.06	2.94**	-15.18	45.15	4.85*	3.72
21.	**J-2479× J-2503**	6.78	0.34	0.10	67.17	1.98	16.81	43.42	4.25**	-2.19
22.	**J-2479× J-2507**	7.00	2.89	0.05	68.85	1.68*	-2.22	44.51	1.70	4.46
23.	**J-2479× J-2508**	7.99	1.26	0.26*	68.73	2.36	50.80*	44.39	2.54	38.08**
24.	**J-2479× J-2510**	7.05	2.42	0.12	68.81	2.16**	-14.38	44.41	3.82**	-5.80
25.	**J-2482× J-2496**	9.40	5.93**	-0.08	81.96	-0.61+	-2.82	52.82	-3.60**	-6.16
26.	**J-2482× J-2500**	8.86	2.44	1.17**	74.91	-0.04	218.50**	48.79	-4.69	64.45**
27.	**J-2482× J-2503**	7.25	-3.63*	0.01	77.69	1.12	29.65	50.09	2.29	9.50
28.	**J-2482× J-2507**	7.80	-0.91	-0.06	81.25	2.84**	-12.55	52.36	5.09**	-5.02
29.	**J-2482× J-2508**	8.52	0.35	0.62**	57.53	2.63**	-16.82	37.27	4.70**	-0.52
30.	**J-2482× J-2510**	7.07	1.66	0.32*	55.80	-1.20**	-12.24	37.55	-2.31**	-5.95
31.	**J-2496× J-2500**	6.99	3.87	0.35*	67.98	-0.24	0.22	43.98	-1.20	8.35
32.	**J-2496× J-2503**	6.75	2.34*	-0.04	86.30	1.29	66.97*	54.32	2.91	-0.48
33.	**J-2496× J-2507**	6.57	0.65	-0.07	72.41	0.86	39.69	46.79	-0.80	13.94
34.	**J-2496× J-2508**	6.80	-0.04	0.06	77.99	1.56	50.40*	50.21	0.52	23.70*
35.	**J-2496× J-2510**	6.60	-1.13	-0.01	58.21	2.41**	-16.88	37.76	4.22**	-1.74
36.	**J-2500× J-2503**	5.97	2.04**	-0.06	62.69	0.80	-4.89	40.66	1.18	-2.33
37.	**J-2500× J-2507**	6.00	-1.00**	-0.08	72.42	2.38**	3.45	46.76	4.74**	-5.30
38.	**J-2500× J-2508**	6.42	-0.48	-0.06	67.12	2.68	53.24*	43.34	3.19	45.58**
39.	**J-2500× J-2510**	5.89	-1.21	-0.06	63.14	-0.88	-8.34	40.47	-3.42	13.79
40.	**J-2503× J-2507**	7.07	2.69	0.15	71.38	0.74	26.84	46.27	-0.85	8.66
41.	**J-2503× J-2508**	7.54	1.88**	-0.06	68.84	2.49	69.17*	45.36	2.56	21.59*
42.	**J-2503× J-2510**	7.15	2.35**	-0.08	68.84	0.05	-2.09	44.54	-0.48	4.46
43.	**J-2507× J-2508**	6.51	-0.69	-0.06	72.91	1.06	10.07	47.01	0.02	4.52
44.	**J-2507× J-2510**	6.55	0.72**	-0.08	69.43	-1.41	32.01	44.97	-3.14	40.79**
45.	**J-2508× J-2510**	7.22	2.81**	-0.04	60.20	1.57	34.39	39.02	1.03	20.54*
Mean		**7.43**	-	-	**70.99**	-	-	**45.92**	-	-

*, ** Indicates significance at P = 0.05 and P = 0.01 levels, respectively

Table 5: Stability parameters of different genotypes for Grain yield per plant, 1000 grain weight and panicle index (%) in pearl millet

Sr. No.	Genotypes	Grain yield per plant (g)			1000 grain weight (g)			Panicle index (%)		
		Mean	b_i	S^2d_i	Mean	b_i	S^2d_i	Mean	b_i	S^2d_i
Parents										
1.	**J- 2433**	29.91	-0.53	9.21*	8.04	3.50**	-0.04	170.57	0.08	24.14
2.	**J-2479**	29.95	2.45*	-0.17	7.33	-1.59	0.08	161.66	1.27	120.46**
3.	**J-2482**	30.65	1.06	-0.00	7.53	-1.69	0.97**	164.83	0.76	234.86**
4.	**J-2496**	26.97	1.24	6.15	8.00	0.27	-0.07	157.23	0.63	-6.93
5.	**J-2500**	25.65	1.84**	-2.96	7.80	5.14**	-0.01	153.72	1.48**	-12.54
6.	**J-2503**	25.25	0.68	4.30	8.43	2.24	0.10	150.48	0.93	19.51
7.	**J-2507**	27.10	0.77	-1.99	8.60	-0.50**	-0.14	164.89	-0.44	26.08
8.	**J-2508**	25.40	-1.36**	-2.84	8.05	-0.57	-0.02	167.44	-1.38	45.16
9.	**J-2510**	24.74	1.55	2.23	7.47	0.11	0.04	150.96	-0.92*	-9.54
Crosses										
10.	**J-2433 × J-2479**	36.84	1.35	10.77*	9.48	1.89	3.15**	148.78	0.75*	-12.39
11.	**J-2433 × J-2482**	36.40	1.56	4.61	8.09	-0.81**	-0.14	150.14	1.01**	-15.44
12.	**J-2433× J-2496**	31.51	2.56	2.52	8.05	5.07**	-0.05	151.05	1.12**	-11.98
13.	**J-2433× J-2500**	29.41	0.30	-2.80	8.73	-1.50**	-0.13	152.30	1.41**	-15.98
14.	**J-2433× J-2503**	34.20	2.97**	-2.57	9.77	2.00**	-0.14	152.05	1.38**	-15.81
15.	**J-2433× J-2507**	35.54	1.69*	-1.84	8.70	4.21**	-0.14	151.88	1.35**	-16.05
16.	**J-2433× J-2508**	31.73	2.62	3.48	9.67	-4.28**	-0.12	152.39	1.37**	-15.09
17.	**J-2433× J-2510**	32.65	1.42	10.30*	7.43	-2.21	0.52*	152.17	1.38**	-16.22
18.	**J-2479× J-2482**	34.12	3.83**	0.48	8.17	-1.21	0.01	151.35	1.26**	-11.70
19.	**J-2479× J-2496**	34.06	0.19	-2.22	8.34	1.50*	-0.10	148.77	1.40*	1.38
20.	**J-2479× J-2500**	29.38	1.29	7.76	8.50	4.91*	0.23	153.95	1.59**	-13.08
21.	**J-2479× J-2503**	28.70	3.13**	-1.70	9.17	0.73	0.22	151.88	1.73**	-15.08
22.	**J-2479× J-2507**	29.56	0.29	3.11	8.30	-0.67	0.32	150.91	0.97	1.12
Sr. No.	**Genotypes**	**Grain yield per plant (g)**			**1000 grain weight (g)**			**Panicle index (%)**		
		Mean	**b_i**	**S^2d_i**	**Mean**	**b_i**	**S^2d_i**	**Mean**	**b_i**	**S^2d_i**
23.	**J-2479× J-2508**	29.20	-0.90	7.17	9.21	6.65	0.81*	151.68	1.10**	-14.39
24.	**J-2479× J-2510**	28.81	1.38	3.52	6.87	2.65**	-0.13	154.33	0.72**	-15.67
25.	**J-2482× J-2496**	35.23	-0.01	4.79	8.42	2.50	0.82*	150.08	0.97	-1.81
26.	**J-2482× J-2500**	31.95	-3.39**	-0.91	7.82	0.34	0.11	152.22	1.25**	-16.22
27.	**J-2482× J-2503**	33.24	3.33**	-1.94	8.25	-1.01	0.44*	151.45	1.63**	-15.70
28.	**J-2482× J-2507**	34.46	2.24	5.81	7.50	0.90	0.05	152.05	1.34**	-15.26
29.	**J-2482× J-2508**	24.32	1.34	10.37*	7.65	-0.27	0.85**	153.44	1.33**	-14.45
30.	**J-2482× J-2510**	24.56	-0.10	1.84	7.40	-1.03**	-0.13	153.38	1.37**	-16.24
31.	**J-2496× J-2500**	29.28	1.75	5.27	8.39	2.71**	-0.10	151.42	1.18**	-16.24
32.	**J-2496× J-2503**	34.93	2.05**	-3.07	9.23	-0.75	0.22	156.03	0.70	-7.59
33.	**J-2496× J-2507**	31.08	-0.89	-2.15	9.55	3.65	1.80**	150.58	0.93	0.60
34.	**J-2496× J-2508**	32.22	-1.80	3.25	8.47	1.87*	-0.10	156.55	-0.35**	-16.22
35.	**J-2496× J-2510**	24.62	1.32	6.39	7.87	4.44**	-0.14	153.40	1.34**	-14.75
36.	**J-2500× J-2503**	27.54	1.81**	-3.05	8.33	4.55**	0.02	147.66	1.00*	-8.17
37.	**J-2500× J-2507**	30.76	2.73*	1.33	9.60	3.57**	-0.08	152.44	1.36**	-15.18
38.	**J-2500× J-2508**	28.34	-0.71	14.36*	8.30	1.16	-0.10	152.60	1.23**	-16.06
39.	**J-2500× J-2510**	26.56	1.43	23.43**	7.20	-1.03**	-0.13	153.07	1.43**	-16.22
40.	**J-2503× J-2507**	30.84	-0.86**	-3.00	9.20	-0.52**	-0.14	149.86	0.81**	-14.71
41.	**J-2503× J-2508**	30.03	0.19	3.25	9.73	2.21**	-0.14	151.15	1.79**	-15.39
42.	**J-2503× J-2510**	29.21	2.11	2.45	8.93	-4.51	0.85**	153.31	1.51**	-12.65
43.	**J-2507× J-2508**	30.97	-0.12	-2.97	9.60	2.54*	-0.03	152.43	1.29**	-16.12
44.	**J-2507× J-2510**	29.64	2.41	30.83**	9.20	0.82	0.53*	152.60	1.43**	-16.24
45.	**J-2508× J-2510**	26.05	-1.28	-1.34	7.99	-2.74**	-0.13	149.83	0.93	16.78
Mean		**30.03**	-	-	**8.40**	-	-	**153.45**	-	-

*, ** Indicates significance at P = 0.05 and P = 0.01 levels, respectively

Table 6: Stability parameters of different genotypes for total biomass per plant and harvest index in pearl millet

Sr. No.	Genotype	Total biomass per plant (g)			Harvest index (%)		
		Mean	b_i	S^2d_i	Mean	b_i	S^2d_i
Parents							
1.	**J- 2433**	94.35	0.45	-6.54	31.70	-0.43	10.45*
2.	**J-2479**	90.33	4.22	53.24*	33.08	0.43	-0.58
3.	**J-2482**	90.76	-3.38	1.75	33.92	1.82	1.65
4.	**J-2496**	90.56	-1.61	12.43	29.80	1.77*	-2.36
5.	**J-2500**	72.67	-0.54	-8.17	35.40	4.27**	-1.61
6.	**J-2503**	73.44	-1.33	75.04*	34.40	-0.27	-2.41
7.	**J-2507**	84.04	0.83	-2.83	32.38	1.62**	-2.40
8.	**J-2508**	88.15	-1.81**	-15.26	28.83	-1.25**	-2.51
9.	**J-2510**	79.75	1.99	67.39*	30.95	-0.01	-1.65

Sr. No.	Genotype	Total biomass per plant (g)			Harvest index (%)		
		Mean	b_i	S^2d_i	Mean	b_i	S^2d_i
Crosses							
10.	**J-2433 × J-2479**	101.71	4.86*	6.33	36.15	0.27	-2.52
11.	**J-2433 × J-2482**	102.75	3.66**	-13.26	35.37	0.33	-1.27
12.	**J-2433× J-2496**	94.43	2.22**	-14.96	33.16	1.73	4.29
13.	**J-2433× J-2500**	92.88	3.96	12.85	31.72	0.32	3.75
14.	**J-2433× J-2503**	95.28	3.28**	-14.68	36.06	2.65**	-1.97
15.	**J-2433× J-2507**	95.85	1.19**	-15.45	37.13	2.07**	-2.06
16.	**J-2433× J-2508**	93.20	5.32**	-12.03	34.05	1.48**	-2.25
17.	**J-2433× J-2510**	92.82	-2.68	-2.242	35.25	2.74**	-2.49
18.	**J-2479× J-2482**	95.51	3.41	63.09*	35.56	2.03**	-2.55
19.	**J-2479× J-2496**	100.70	4.18**	-12.50	33.97	-0.22	9.68*
20.	**J-2479× J-2500**	95.46	1.36	30.04	30.79	1.712	1.98
21.	**J-2479× J-2503**	91.13	3.52**	-15.14	31.61	2.86*	-1.35
22.	**J-2479× J-2507**	85.81	-0.04	-2.511	34.59	0.54	1.46
23.	**J-2479× J-2508**	87.71	1.21	50.17*	33.96	-0.49**	-2.55
24.	**J-2479× J-2510**	89.80	5.98**	-8.02	32.15	-0.09	-2.37
25.	**J-2482× J-2496**	98.24	-3.99**	-14.77	35.91	1.78**	-2.58
26.	**J-2482× J-2500**	88.46	-4.55	26.52	36.10	-0.81	1.16
27.	**J-2482× J-2503**	90.83	1.21	-0.98	36.58	3.17**	-1.23
28.	**J-2482× J-2507**	88.27	4.55*	0.65	39.00	1.80**	-2.29
29.	**J-2482× J-2508**	76.00	4.78*	7.17	32.03	0.39	-1.37
30.	**J-2482× J-2510**	77.42	-4.71**	-10.38	31.86	2.97**	-2.58
31.	**J-2496× J-2500**	79.90	0.98*	-14.66	36.56	3.65	7.036
32.	**J-2496× J-2503**	95.29	3.70*	-6.68	36.80	0.35	-1.92
33.	**J-2496× J-2507**	76.36	-0.13	8.37	40.76	0.11	-2.05
34.	**J-2496× J-2508**	93.82	1.12**	-15.40	34.47	-3.25**	-2.35
35.	**J-2496× J-2510**	69.50	3.94**	-13.20	35.33	-1.08	0.97
36.	**J-2500× J-2503**	78.42	0.09	-15.12	35.09	2.49*	-0.62
37.	**J-2500× J-2507**	82.77	4.23**	-14.53	37.08	1.31	-0.67
38.	**J-2500× J-2508**	77.29	1.96	1.85	36.67	-1.99	-0.16
39.	**J-2500× J-2510**	82.48	-5.83**	-11.22	32.25	5.03**	-2.28
40.	**J-2503× J-2507**	88.55	-1.08**	-15.45	34.79	-1.01**	-2.54
41.	**J-2503× J-2508**	79.98	2.43	10.78	37.50	0.06	-2.56
42.	**J-2503× J-2510**	90.01	-1.09	-4.42	32.46	2.95**	-2.42
43.	**J-2507× J-2508**	95.78	-0.41	43.86	32.25	1.42*	-2.03
44.	**J-2507× J-2510**	71.45	0.55	122.31**	41.40	1.40	4.66
45.	**J-2508× J-2510**	83.12	-0.16	-14.41	31.33	-2.03**	-2.43
Mean		**87.58**	-	-	**34.37**	-	-

*, ** Indicates significance at P = 0.05 and P = 0.01 levels, respectively

Table 7: Stability parameters of different genotypes for Fe & Zn content (ppm) in pearl millet

Sr. No.	Genotype	Fe content (ppm)			Zn content (ppm)		
		Mean	b_i	S^2d_i	Mean	b_i	S^2d_i
Parents							
1.	**J- 2433**	59.67	2.05**	-17.81	44.78	1.27**	-9.06
2.	**J-2479**	71.89	2.48*	-9.76	45.89	1.41**	-8.53
3.	**J-2482**	76.67	1.70	-9.16	43.67	0.37	-8.93
4.	**J-2496**	61.41	-0.66	-11.51	40.22	0.44**	-9.15
5.	**J-2500**	62.67	0.84**	-17.84	46.11	-0.43**	-9.11
6.	**J-2503**	74.00	2.05**	-17.81	36.33	1.33**	-9.17
7.	**J-2507**	59.89	1.80**	-17.90	40.56	1.40**	-9.07
8.	**J-2508**	66.54	0.55	-16.64	41.78	1.06**	-8.54
9.	**J-2510**	68.89	-0.48	-15.19	44.11	1.11	-6.79
Crosses							
10.	**J-2433 × J-2479**	79.67	2.07**	-17.81	43.78	3.51	46.47*
11.	**J-2433 × J-2482**	73.33	2.05**	-17.81	43.00	0.43	-1.40
12.	**J-2433× J-2496**	71.85	2.07**	-17.81	32.44	1.47**	-8.86
13.	**J-2433× J-2500**	75.68	2.05**	-17.81	39.56	-1.23	49.66*
14.	**J-2433× J-2503**	72.20	2.05**	-17.80	43.00	1.33**	-9.17
15.	**J-2433× J-2507**	69.00	2.07**	-17.81	48.11	-0.05	-9.13
16.	**J-2433× J-2508**	75.22	1.935**	-18.00	43.33	1.33**	-9.17
17.	**J-2433× J-2510**	55.56	-0.92	-15.09	40.00	1.54**	-8.54
18.	**J-2479× J-2482**	81.57	2.05**	-17.81	39.67	1.33**	-9.17
19.	**J-2479× J-2496**	56.84	-1.25	-0.57	39.00	1.33**	-9.17
20.	**J-2479× J-2500**	60.21	0.71**	-17.63	38.33	1.33**	-9.17
21.	**J-2479× J-2503**	64.08	1.92**	-15.86	49.89	1.15	-1.89
22.	**J-2479× J-2507**	60.56	1.59	-1.89	48.22	0.06	-9.13

Sr. No.	Genotype	Fe ppm			Zn ppm		
		Mean	b_i	S^2d_i	Mean	b_i	S^2d_i
23.	**J-2479× J-2508**	62.49	1.05*	-16.03	45.22	0.04	-7.79
24.	**J-2479× J-2510**	52.91	-2.72**	-17.64	42.78	0.85	-6.95
25.	**J-2482× J-2496**	71.03	2.05**	-17.81	48.00	1.33**	-9.17
26.	**J-2482× J-2500**	55.36	0.78	-2.48	43.33	1.68**	-7.40
27.	**J-2482× J-2503**	56.03	0.32	-11.88	45.67	1.33**	-9.17
28.	**J-2482× J-2507**	64.73	2.02**	-17.52	36.22	1.22**	-8.83
29.	**J-2482× J-2508**	56.09	2.01**	-17.66	46.67	2.46**	-8.97
30.	**J-2482× J-2510**	82.67	2.05**	-17.81	41.56	-0.96	26.64*
31.	**J-2496× J-2500**	62.05	1.50**	-17.95	42.33	1.74*	-6.97
32.	**J-2496× J-2503**	70.33	2.02**	-17.52	43.00	1.33**	-9.17
33.	**J-2496× J-2507**	67.52	1.88**	-14.92	37.33	1.33**	-9.18
34.	**J-2496× J-2508**	58.26	-0.76	-0.90	47.00	1.33**	-9.17
35.	**J-2496× J-2510**	106.51	2.66**	-11.55	38.00	1.33**	-9.18
36.	**J-2500× J-2503**	95.16	-0.54	-15.12	39.22	-1.45	77.34**
37.	**J-2500× J-2507**	96.26	-1.72	123.59**	48.22	1.35	-5.14
38.	**J-2500× J-2508**	62.78	0.85	-9.38	39.00	1.33**	-9.17
39.	**J-2500× J-2510**	68.76	1.62	4.55	38.78	0.32**	-9.14
40.	**J-2503× J-2507**	62.78	0.63	12.97	39.67	1.33**	-9.17
41.	**J-2503× J-2508**	76.90	1.77**	-17.67	44.00	0.26	3.16
42.	**J-2503× J-2510**	56.00	0.32	-9.28	38.33	1.33**	-9.17
43.	**J-2507× J-2508**	57.78	-2.41	15.24	37.67	1.33**	-9.17
44.	**J-2507× J-2510**	60.89	0.94	-9.64	42.00	1.54**	-8.54
45.	**J-2508× J-2510**	57.56	0.44	-17.53	40.89	1.63	-5.29
Mean		**67.75**	-	-	**42.17**	-	-

*, ** Indicates significance at P = 0.05 and P = 0.01 levels, respectively

Table 8: The most widely adapted hybrids identified on the basis of grain yield per plant along with their stability for component traits in pearl millet

Sr. No.	Crosses	Mean (gm)	Stable yield attributes
1	**J-2433 × J-2482**	**36.40**	Number of nodes on main stem, Plant height, Ear head length, Ear head girth, Harvest index, Zn content
2	**J-2482 × J-2496**	**35.23**	Number of nodes on main stem, Green ear head weight
3	**J-2482 × J-2507**	**34.46**	Days to 50% flowering, Days to maturity, Ear head length, Ear head girth
4	**J-2479 × J-2496**	**34.06**	Number of nodes on main stem, Number of effective tillers per plant, Plant height, Ear head girth, Green ear head weight, Dry ear head weight
5	**J-2496 × J-2508**	**32.22**	Days to maturity, Ear head length
6	**J-2433 × J-2508**	**31.73**	Number of nodes on main stem, Plant height
7	**J-2433 × J-2496**	**31.51**	Plant height
8	**J-2496 × J-2507**	**31.08**	Plant height, Green ear head weight, Dry ear head weight, Harvest index
9	**J-2507 × J-2508**	**30.97**	Days to maturity, Plant height, Ear head length, Green ear head weight, Dry ear head weight, Total biomass per plant

References

1. Anarase SA, Ugale SD, Moholkar ND. Phenotypic stability of yield and yield components in pearl millet. J Maharashtra Agric. Univ. 2001; 25(3):258-261.
2. Anonymous. Directorate of Agriculture, Department of Agriculture, Gujarat state, 2017.
3. Bradshaw AD. Evolutionary significance of plasticity in plants. Adv. Genet. 1965; 13:115-155.
4. Ceccarelli S. Wide adaptation, How wide? Euphytica, 1989; 40:197-205.
5. Chaudhary BS, Subarao GV, Saxena MB, Manga VK. Note on phenotypic stability in population vs. hybrids of pearl millet. Ind. J Agric. Sci. 1981; 51:457.
6. Chavan AA, Nerkar YS. Heterosis and combining ability studies for grain yield and its components in pearl millet. J Maharashtra agric. Uni. 1994; 19(1):58-61.
7. Chikurte KN, Desale JS, Anarase SA. Genotype x environment interaction for yield and yield components in pearl millet. J Maharashtra Agric. Univ. 2003; 28(1):30-33.
8. Eberhart SA, Russell WA. Stability parameters for comparing varieties. Crop Sci. 1966; 6(1):36-40.
9. Finlay KW, Wilkinson GN. The analysis of adaptation in a plant breeding programme. Aust. J Agric. Res. 1963; 14(6):742-754.
10. Grafius JE. Heterosis in barley. Agron. J. 1959; 40(1):58-83.
11. Gupta SC, Nyode AT, Andrews DJ. Variety trials of millet in Senegal. Agro. Tro. 1983; 38:229-233.
12. Gupta SC, Nyode AT. Yield stability analysis of promising pearl millet genotypes in Senegal. Maydica. 1991; 36(1):83-86.
13. Hanif M, Fatech J, Javed HI, Malik HN, Hussain M. Stability analysis of millet varieties across diverse environments in pakistan. Sarhad, J Agric. 2001; 3(2):243-249.
14. Karale MU, Ugale SD, Suryavanshi YB, Patil BD. Heterosis in line x tester crosses in pearl millet. Indian J agric. Res. 1997; 31(1):39-42.
15. Kumar MH, Sahib KH. Phenotypic stability for grain and fodder yields in pearl millet. J Res. ANGRAU. 2003; 31(4):39-42.
16. Monyo ES, Mgonja MA, Chandari S, Chinhema E. Relative stability of selected pearl millet varieties from southern africa. African Crop Science Conference Proceedings. 2000; 6(1):90-92.

17. Pethani KV, Kapoor RL. Phenotypic stability for grain yield in pearl millet. Ind. J Genet. 1985; 45:362-367.
18. Prajapati BH, Patel NM, Khokhar AN. Genotype x environment interaction and stability analysis in pearl millet (*Pennisetum americanum* L.). Guj. Agric. Univ. Res. J. 1998; 24(1):62-66.
19. Raiger HL, Prabhakaran VT. A study on the performance of a few non-parametric stability measures using pearl-millet data. Ind. J Genet. 2001; 61(1):7-11.
20. Scott GE. Selecting for stability of yield in maize. Amer. Breeders Assoc. Rept. In Heterosis, (Ed. J.W. Gowen). Iowa State College Press. Amer, Iowa, USA, 1967; 4:296-301.
21. Shinde GC, Bhingarde MT, Khaimar MT, Methetre SS. AMMI analysis for stability of grain yield pearl millet (*Pennisetum typhoides* L.). Hybrids. Ind. J Genet. Pl. Breed. 2001; 62(3):215-217.
22. Singh S, Gupta PK. Phenotypic stability in pearl millet. Ind. J Genet. 1978; 38:444-451.
23. Singh OV, Singh AK. Assessment of G x E interaction in pearl millet (*Pennisetum glaucum* (L.) R. Br.). germplasm in hot-arid climate of Rajasthan. Ind. J Agric. Res. 2016; 50(1):92-95.
24. Suryavanshi YB, Ugale SD, Patil RB. Phenotypic stability of yield and yield components in pearl millet. J Maharashtra Agric. Univ. 1991; 16(2):218-221.
25. Umaretiya SV. Line x tester studies on heterosis, gene action and phenotypic stability in pearl millet (*Pennisetum glaucum* (L.) R. Br.), Unpublished M.Sc. (Agri.) thesis submitted to Junagadh Agricultural University, Junagadh.
26. Wedajo. Evaluation of pearl millet (*Pennisetum glaucum* L.) Genotypes for yield and yield stability in south omo and west hararghe. J of Bio. Agric. Healthcare. 2014; 4(8):143-148.
27. Yadav R, Yadav HP, Chandra B. Stability analysis for grain yield in pearl millet. Agric. Sci. Dig. est. 1997; 17(3):175-177.
28. Yates F, Cochran WG. The analysis of groups of experiments. J Agril. Sci. 1938; 28(4):556-580.