Electronic Journal of Plant Breeding, 9 (2) : 598-602 (June 2018) DOI: 10.5958/0975-928X.2018.00073.X
ISSN 0975-928X

Research Article

Heterosis for grain yield in rice (*Oryza sativa*) under coastal salinity condition

P. B. Vanave[1]*, U. B. Apte[1], S. G. Bhave[1] and B. D. Jadhav[2]
[1]Dr. B.S. Konkan Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri, Maharashtra
[2]Navsari Agricultural University, Navsari, Gujarat.
E-Mail: pbvanave@gmail.com

(Received:05 Dec 2017; Revised:31 May 2018; Accepted:31 May 2018)

Abstract
The present experiment was undertaken with line x tester mating design involving 12 testers (male) and 4 lines (female) to identify the best heterotic combinations. Pooled analysis of heterotic combinations for grain yield revealed range from -20.92% (NAUR 1 x GR 11) to 26.43% (NAUR 1 x CSR 27) for average heterosis, -28.99% (NAUR 1 x GR 11) to 19.87% (GAR 13 x NVSR 6108) for heterobeltiosis, and -11.03 (NAUR 1 x GR 11) to 49.91% (NAUR 1 x CSR 27). Further, based on pooled analysis, best crosses with more than 30% heterosis were NAUR 1 x CSR 27 (49.91%), NAUR 1 x Dandi (48.98%), Panvel 1 x NVSR 6108 (35.93%), NAUR 1 x IR 76346-B -B-10-1-1-1 (33.73%), NAUR 1 x NVSR 6100 (32.62%), Panvel 1 x Dandi (32.56%) and NAUR 1 x NVSR 6108 (32.33%) over check CST 7-1.

Keywords
Rice, line x tester, heterosis, heterobeltiosis

Introduction

Rice is an important cereal crop in India. The productivity of rice is being affected by biotic and abiotic factors. Among the various abiotic factors, salinity is an important yield limiting factor in coastal saline areas. The total salt affected area in India is approximately occupying 6% of the global land surface and 2% of the geographical area Yadav(2003). Total salt affected area in Gujarat is 22.22 lakh ha comprising coastal salinity with 16.80 lakh ha and sodicity with 5.4 lakh ha Mandal and Sharma (2008). Rice is generally a salt sensitive crop. However, there are large number of varieties, which show variations towards salt tolerance. It is necessary to evolve saline tolerant and high yielding varieties of rice for the coastal saline areas. Commercial exploitation of heterosis in crop plants is a major breakthrough in the field of plant breeding. Heterosis studies guide the breeder in identifying crosses that are likely to throw transgressive segregants Singh and Jain (1979). The measures of heterosis over mid parent (average heterosis), better parent (heterobeltiosis) and over standard check (standard heterosis) are better rational parameters for assessing its practical utility. In the present study an attempt was made to assess heterosis of 48 hybrids under coastal saline situation.

Material and Methods

The experimental material for the present investigation consisted of 16 parents (4 females and 12 males), their 48 crosses and one variety *viz*., CST 7-1 as standard check. Three complete sets of 65 entries comprising 48 F_1's, 4 females, 12 males and 1 check were evaluated during *kharif* 2014. The trials were conducted in Randomized Block Design, replicated thrice at three research stations *viz*., Central Soil Salinity Research Station, Danti (E_1), Central Soil Salinity Research Station, Umbharat (E_2), and Central Soil Salinity Regional Research Substation, Samany (E_3). The soil salinity of the experimental site was assessed by measuring electrical conductivity and expressed in dS/m. On the basis of electrical conductivity the sites were moderate saline in reaction during harvesting stage and non saline in reaction during early growth stages.

The parents and F_1's with standard check were represented by a single row plot of 10 plants placed at 20 cm x 15 cm spacing. All the recommended agronomical practices and plant protection measures were followed as and when required to raise a good crop of rice.

In the present investigation, heterosis over mid parent, better parent (heterobeltiosis) and standard heterosis over CST 7-1 were studied for grain yield per plant. . The results are discussed as below.

Particulars	**Locations**								
	Danti (E_1)			**Umbharat (E_2)**			**Samany (E_3)**		
	S_1	S_2	S_3	S_1	S_2	S_3	S_1	S_2	S_3
ECe	1.1	1.2	4.1	1.4	1.7	4.3	1.3	2.2	4.0
pH	7.2	7.2	7.2	7.2	7.1	7.2	7.7	7.7	7.5
Location details:									
E_1: CSSRS, Danti, Navsari Agricultural University (N.A.U.), Navsari.									
E_2: CSSRS, Danti – Umbharat (old farm) N.A.U., Navsari.									
E_3: Central Soil Salinity Research Substation (ICAR), Samany, Bharuch.									
S_1 : Transplanting, S_2 : Flowering and S_3 : Harvesting stage									

Results and Discussion

The magnitude of average heterosis ranged from -16.65% (GNR 3 x IR 76346-B-B-10-1-1-1) to 38.36% (GAR 13 x Pokkali) in E_1, -35.94% (NAUR 1 x GR 11) to 33.87% (GAR 13 x IR 71895-3R-9-3-1) in E_2, -40.92% (NAUR 1 x GR 11) to 37.37% (GAR 13 x IR 71907-3R-2-1-2) in E_3 and -20.92% (NAUR 1 x GR 11) to 26.43% (NAUR 1 x CSR 27) in pooled analysis.

Significant and positive average heterosis was expressed in 35, 24, 21 and 33 crosses in E_1, E_2, E_3 and pooled analysis, respectively. Further, based on pooled analysis, best three crosses were NAUR 1 x CSR 27 (26.43%), Panvel 1 x GNR 2 (25.76%) and GAR 13 x Kalarata (25.09%). Perusal of estimates of average heterosis over environments revealed that out of 48 crosses, 33 crosses exhibited high degree of average heterosis for grain yield plant^{-1} (Table 1) and its range was very wide (-11.03% to 49.91%). Low to high range of average heterosis for grain yield plant^{-1} was reported by Shahi *et al*. (2012), Rogbell *et al*. (1998) and Sharifi (2012).

The highest relative heterosis of 26.43% for grain yield plant^{-1} was manifested by cross NAUR 1 x CSR 27 followed by Panvel 1 x GNR 2 (25.76%) and GAR 13 x GNR 2 (23.77%).

The magnitude of heterobeltiosis was ranged from -23.50% (GNR 3 x CSR 23) to 19.05% (NAUR 1 x CSR 27) in E_1, -40.30% (NAUR 1 x GR 11) to 22.56% (GAR 13 x IR 71895-3R-9-3-1) in E_2, -46.34% (NAUR 1 x GR 11) to 35.42% (GAR 13 x IR 71907-3R-2-1-2) in E3 and -28.99% (NAUR 1 x GR 11) to 19.87% (GAR 13 x NVSR 6108) in pooled analysis. Perusal of estimates of heterobeltiosis over environments revealed that out of 48 crosses 18 crosses exhibited moderate degree of positive heterobeltiosis for grain yield plant^{-1} (Table 1) and its range was (-28.99 to 19.87%). Low to very high range of heterobeltiosis for grain yield plant^{-1} were reported by many workers *viz.*, Sajjad and Awan (1988), Sajjad (1998), Rogbell *et al*. (1998), Mishra *et al*., (2003), El-Mouhamady *et al*. (2010), Shahi *et al*. (2012) and Gopikannan and Ganesh (2013b).

Significant and positive heterobeltiosis was expressed in 12, 8, 12 and 18 crosses in E1, E2, E3 and pooled analysis, respectively. Further, based on pooled analysis, best three crosses were GAR 13 x NVSR 6108 (19.87%), NAUR 1 x CSR 27 (19.64%) and NAUR 1 x Dandi (18.90%). It is interesting to note that, though this hybrid manifested highest heterobeltiosis on the basis of pooled data, the *per se* performance was not highest. The highest heterobeltiosis in these crosses is mainly attributed to lower yielding ability of the better parent. Significant positive heterosis for grain yield plant^{-1} over better parent and check might be due to greater genetic diversity among the parents. The similar findings have been reported by many researchers, some of them are Paramasivan (1986), Sajjad (1986), Sajjad and Awan (1988), Ali *et al*. (1998), Rogbell *et al*. (1998), Thirumeni *et al*. (2000), Thirumeni and Subramanian (2000), Mishra *et al*. (2003), Babu *et al*. (2005), Geetha *et al*. (2005), Deepa *et al*. (2008), Sankar *et al*. (2008), El-Mouhamady *et al*. (2010), Shahii *et al*. (2012), El-Mouhamady *et al*. (2013) and Gopikannan and Ganesh (2013b).

The magnitude of standard heterosis ranged from -13.93 to 36.93%, -26.69 to 44.09%, -23.98 to 75.41% and -11.03 to 49.91% in E1, E2, E3 and pooled analysis, respectively. The cross NAUR 1 x CSR 27 recorded maximum significant and positive heterosis of 49.91% over check followed by NAUR 1 x Dandi (48.98%) and Panvel 1 x NVSR 6108 (35.93%) across the environments. The cross NAUR 1 x GR 11 expressed significantly negative values for standard heterosis (-11.03%) in pooled analysis.

Number of crosses exhibiting significant positive standard heterosis over check were 27, 27, 36 and 40 in E1, E2, E3 and across the environments, respectively. Further, based on pooled analysis, best crosses with more than 30% heterosis were NAUR 1 x CSR 27 (49.91%), NAUR 1 x Dandi (48.98%), Panvel 1 x NVSR 6108 (35.93%), NAUR 1 x IR 76346-B -B-10-1-1-1 (33.73%), NAUR 1 x NVSR 6100 (32.62%), Panvel 1 x Dandi (32.56%) and NAUR 1 x NVSR 6108 (32.33%).

References

Babu, S., Yogammenakshi, P., Sheeba, A., Anbumalarmathi, J. and Rangasamy, P. (2005). Heterosis in rice under salt affected environments. *Madras Agriculture Journal*, **92** (7-9): 369-374.

Deepa, S.P., Subbaraman, N. and Lakshmi Narayanan, S. (2008). Heterosis, combining ability and gene action studies in TGMS based rice hybrids under normal and salt affected environments. *Indian Journal of Agricultural Research*, **42** (3):177-182.

El-Mouhamady, A.A., El-Demardash, I.S. and Aboud, K.A. (2010). Biochemical and molecular genetic studies on rice tolerance to salinity. *Journal of American Science*, **6** (11): 521-535.

El-Mouhamady, A. A., Reddy, M. R. and El-Demardash, S. (2013). Molecular genetic studies on agronomic traits in rice using the methods of biotechnology. *Research Journal of Agriculture & Biological Sciences*, **9** (1): 17-26.

Geetha, S., Mohandas, S., Mohammed, S.E.N. and Anthoniraj, S. (2005). Evaluating sodicity tolerance in rice hybrids. *International Rice Research Notes*, **30** (2): 26-27.

Gopikannan, M. and Ganesh, S.K. (2013b). Genetic analysis of sodicity tolerance in rice (*Oryza Sativa* L.). *International Journal of Agriculture, Environment & Biotechnology*, **6** (4): 527-531.

Mandal, A.K. and Sharma, R.C. (2008). Computerized database on salt affected soils in western and central India using GIS. *Geocarto International*, **23** (5): 373-391. DOI:10.1080/10106040701207589.

Mishra, B., Singh, R. K. and Senadhira, D. (2003). Advances in breeding salt tolerant rice varieties. In : (Eds). Khush, G.S., D.S. Brar and B. Hardy. *Advances in Rice Genetics*. *Supplement to rice Genetics IV*. Proceeding of the Fourth International Rice Genetics Symposium, 22-27 October 2000, Los Banos, Philippines. IRRI. pp 5-7.

Paramasivan, K.S. (1986). Estimation of heterosis in crosses involving saline resistant rice cultures. *Journal of Madras Agri*culture, **73** (12): 679-689.

Rogbell, J.E., Subbaraman, N. and Karthikeyan, C. (1998). Heterosis in rice (*Oryza sativa* L.) under saline stress condition. *Journal Crop Research*, **15** (1): 68 – 72.

Sajjad, M.S. (1986). Cytoplasmic effect for non-saline and saline environment in rice. *Pakistan Journal of Science and Industrial Research*, 59-60.

Sajjad, M.S. (1998). Manifestation of heterosis in rice (*Oryza sativa* L.) in a saline environment, *International Rice Research Newsletter*, **13** (6): 21-22.

Sajjad, M.S. and Awan, M.A. (1988). Harnessing heterosis in rice under saline envronments. *Pakistan Journal Agriculture Research*, **9** **(**2): 147-150.

Sankar, P.D., Subbaraman, N. and Narayanan, S.L. (2008). Heterosis, combining ability and gene action studies in TGMS based rice hybrids under normal and salt affected environments. *Indian Journal of Agricultural Research*, **42** (3): 177-182.

Shahi, K.B., Dwivedi, S., Archana Devi, Ranjan Dwivedi, Singh, P.K. and Dwivedi, D.K. (2012). Heterosis in diverse ecotypes of rice under saline-alkali environment. *International Journal of Current Research*, **4** (9): 106-110.

Sharifi, P. (2012). Graphic analysis of salinity tolerance traits of rice (*Oryza sativa* L.) using biplot method. *Cer. Res. Comm.* **40** (3): 342-350.

Singh, S. and Jain, R.P. (1979). Heterosis in mungbean. *Indian Journal Genetics*, **30**: 244-250.

Thirumeni, S. and Subramanian, M. (2000). Heterosis in coastal saline rice (*Oryza sativa* L). *Journal Crop Research*, **19** (2): 245-250.

Thirumeni, S., Subramanian, M. and Paramasivam, K. (2000). Combining ability and gene action in rice under salinity. *Tropical Agricultural Research*, **12**: 375-380.

Yadav, J.S.P. (2003). Managing soil health for sustained high productivity. *Journal of the Indian Society of Soil Science*, **51**: 448–465.

Electronic Journal of Plant Breeding, 9 (2) : 598-602 (June 2018) DOI: 10.5958/0975-928X.2018.00073.X
ISSN 0975-928X

Table 1. Estimates of heterosis over mid parent (MP), better parent (BP) and standard check (SC) under individual environment and pooled over environments for grain yield plant^{-1} (g)

Sr. No.	Name of the crosses	Location-I			Location-II			Location-III			Pooled		
		MP	BP	SC	MP	BP	SC	MP	BP	SC	MP	BP	SC
1.	GNR 3 x IR 71907-3R-2-1-2	4.83	-1.95	10.33	6.4	-0.76	10.98	-3.83	-9.61	7.11	2.77	-3.82	9.63 *
2.	GNR 3 x IR 71895-3R-9-3-1	12.25 *	-1.25	11.11	9.2	-3.17	8.28	-2.04	-5.49	11.99	6.73	-3.16	10.39 *
3.	GNR 3 x NVSR 6108	8.14	0.7	13.30 *	10.16	4.83	17.23 *	27.39 **	22.47 **	45.12 **	14.62 **	8.55 *	23.74 **
4.	GNR 3 x NVSR 6100	0.33	-8.11	3.4	5.91	-4.73	6.54	8.5	-2.11	16	4.61	-5.19	8.07
5.	GNR 3 x CSR 23	-10.86	-23.50 **	-13.93 *	-6.34	-18.58 **	-8.95	-3.2	-4.12	13.62	-6.89	-16.09 **	-4.35
6.	GNR 3 x CSR 27	3.97	-1.67	10.64	9.78	7.7	20.44 **	6.01	0.62	32.72 **	6.55	5.55	20.31 **
7.	GNR 3 x Pokkali	14.88 *	-7.65	3.91	11.75	2.72	14.86	-1.43	-8.15	26.02 **	8.18 *	0	13.99 **
8.	GNR 3 x Dandi	-1.33	-2.23	10.02	3.44	2.37	16.89 *	6.21	0.3	33.74 **	2.6	0.74	19.15 **
9.	GNR 3 x GNR 2	-8.95	-19.33 **	-9.23	-17.62 **	-25.83 **	-17.06 *	-4.4	-16.12 *	-0.61	-10.58 **	-20.57 **	-9.46 *
10.	GNR 3 x GR 11	12.74 *	-2.78	9.39	-30.54 **	-32.33 **	-24.32 **	-32.64 **	-33.45 **	-21.14 *	-16.62 **	-21.84 **	-10.91 *
11.	GNR 3 x Kala Rata	25.48 **	9.6	23.32 **	17.03 *	2.27	14.36	9.76	8.06	28.05 **	17.66 **	6.67	21.59 **
12.	GNR 3 x IR 76346-B-B-10-1-1-1	-16.65 **	-21.00 **	-11.11	-17.91 **	-21.75 **	-12.5	-18.63 **	-22.31 **	1.22	-17.69 **	-19.35 **	-8.07
13.	NAUR 1 x IR 71907-3R-2-1-2	16.43 **	7.8	23.99 **	12.00 *	0.14	22.97 **	13.72 *	-1.29	39.84 **	14.09 **	2.28	28.17 **
14.	NAUR 1 x IR 71895-3R-9-3-1	11.41 *	-2.91	11.67	18.97 **	1.38	24.49 **	6.21	-5.6	33.74 **	12.19 **	-2.33	22.38 **
15.	NAUR 1 x NVSR 6108	17.79 **	8.57	24.88 **	12.60 *	2.61	26.01 **	19.19 **	5.6	49.59 **	16.48 **	5.6	32.33 **
16.	NAUR 1 x NVSR 6100	21.98 **	10.61	27.23 **	29.14 **	11.55	36.99 **	13.38 *	-5.16	34.35 **	21.70 **	5.84	32.62 **
17.	NAUR 1 x CSR 23	15.04 **	-2.18	12.52	2.63	-14.17 *	5.41	-23.72 **	-30.56 **	-1.63	-2.17	-15.38 **	6.04
18.	NAUR 1 x CSR 27	27.18 **	19.05 **	36.93 **	23.90 **	16.23 *	42.74 **	28.23 **	23.82 **	75.41 **	26.43 **	19.64 **	49.91 **
19.	NAUR 1 x Pokkali	11.43	-11.16 *	2.19	9.2	-3.71	18.24 *	-3.79	-5.31	34.15 **	5.23	-6.76	16.83 **
20.	NAUR 1 x Dandi	21.17 **	18.78 **	36.62 **	21.60 **	17.33 **	44.09 **	24.32 **	20.66 **	70.93 **	22.33 **	18.90 **	48.98 **
21.	NAUR 1 x GNR 2	3.57	-9.12	4.54	0.88	-12.79 *	7.09	0.97	-17.65 **	16.67	1.85	-13.11 **	8.88 *
22.	NAUR 1 x GR 11	15.45 **	-1.36	13.46 *	-35.94 **	-40.30 **	-26.69 **	-40.92 **	-46.34 **	-23.98 **	-20.92 **	-28.99 **	-11.03 *
23.	NAUR 1 x Kala Rata	24.84 **	8.03	24.26 **	16.20 *	-2.34	19.93 *	3.01	-6.74	32.11 **	14.70 **	-0.23	25.01 **
24.	NAUR 1 x IR 76346-B-B-10-1-1-1	14.30 **	7.22	23.33 **	18.76 **	8.39	33.11 **	8.82	4.45	47.97 **	13.95 **	6.72	33.73 **
25.	GAR 13 x IR 71907-3R-2-1-2	15.59 **	12.37 *	16.59 *	8.49	4.71	8.95	37.37 **	35.42 **	45.33 **	19.64 **	16.49 **	22.17 **
26.	GAR 13 x IR 71895-3R-9-3-1	18.78 **	8.3	12.36	33.87 **	22.56 **	27.53 **	18.69 **	17.16 *	29.07 **	23.75 **	16.66 **	22.34 **
27.	GAR 13 x NVSR 6108	13.80 *	10.11	14.24 *	19.11 **	17.37 *	22.13 **	33.77 **	32.53 **	44.92 **	21.58 **	19.87 **	25.71 **
28.	GAR 13 x NVSR 6100	14.20 *	8.6	12.68 *	18.43 **	10.06	14.53	29.39 **	22.16 **	31.10 **	20.07 **	13.06 **	18.57 **
29.	GAR 13 x CSR 23	19.19 **	5.88	9.86	16.20 *	4.22	8.45	9.45	5.24	22.36 *	15.05 **	7.69	12.94 **
30.	GAR 13 x CSR 27	2.76	1.06	4.85	9.18	7.38	15.54 *	21.33 **	10.02	45.12 **	10.77 **	7.32	20.02 **

Table 1. ***Contd…..***

Sr. No.	Name of the crosses	Location-I			Location-II			Location-III			Pooled		
		MP	BP	SC	MP	BP	SC	MP	BP	SC	MP	BP	SC
31.	GAR 13 x Pokkali	**38.36** **	14.78 *	19.09 **	19.04 **	13.15	17.74 *	-5.74	-16.00 *	15.24	16.58 **	12.06 **	17.53 **
32.	GAR 13 x Dandi	17.90 **	14.31 *	26.29 **	2.17	-2.37	11.49	27.87 **	15.40 *	53.86 **	15.68 **	9.13 *	29.08 **
33.	GAR 13 x GNR 2	20.85 **	11.01	15.18 *	20.94 **	12.5	17.06 *	30.79 **	19.89 *	28.66 **	23.77 **	14.11 **	19.67 **
34.	GAR 13 x GR 11	13.34 *	1.21	5.01	-3.54	-4.46	1.35	-1.55	-5.1	9.76	2.75	0.22	5.11
35.	GAR 13 x Kala Rata	28.50 **	16.29 **	20.66 **	27.63 **	15.10 *	19.76 *	18.76 **	14.87	31.91 **	25.09 **	17.82 **	23.56 **
36.	GAR 13 x IR 76346-B-B-10-1-1-1	15.99 **	14.33 *	18.62 **	19.74 **	18.18 *	22.97 **	14.29 *	4.21	35.77 **	16.68 **	14.27 **	25.01 **
37.	Panvel 1 x IR 71907-3R-2-1-2	25.32 **	17.98 **	30.91 **	21.38 **	12.52	27.53 **	9.17	-1.11	27.03 **	19.04 **	10.16 **	28.64 **
38.	Panvel 1 x IR 71895-3R-9-3-1	10.44	-2.26	8.45	7.86	-4.92	7.77	2.73	-4.59	22.56 *	7.09 *	-3.88	12.25 **
39.	Panvel 1 x NVSR 6108	22.05 **	14.39 *	26.92 **	22.93 **	16.24 *	31.76 **	28.38 **	18.83 **	52.64 **	24.31 **	16.40 **	35.93 **
40.	Panvel 1 x NVSR 6100	16.60 **	7.48	19.25 **	7	-4.32	8.45	22.07 **	6.33	36.59 **	15.08 **	3.18	20.49 **
41.	Panvel 1 x CSR 23	25.82 **	8.6	20.50 **	15.00 *	-0.6	12.67	9.63	4.43	34.15 **	16.89 **	4.22	21.71 **
42.	Panvel 1 x CSR 27	2.81	-2.12	8.61	6.27	3.58	17.40 *	14.75 *	13.25 *	49.39 **	7.84 *	5.57	23.27 **
43.	Panvel 1 x Pokkali	30.54 **	5.5	17.06 **	12.56	2.83	16.55 *	14.77 *	11.11	52.44 **	18.95 **	8.75 *	26.99 **
44.	Panvel 1 x Dandi	18.45 **	18.19 **	31.14 **	15.52 **	15.09 *	31.42 **	3.73	1.83	35.77 **	12.79 **	12.07 **	32.56 **
45.	Panvel 1 x GNR 2	24.53 **	11	23.16 **	18.23 **	5.81	19.93 *	35.63 **	15.03 *	47.76 **	25.76 **	10.54 **	29.08 **
46.	Panvel 1 x GR 11	14.63 *	-0.56	10.33	-9.01	-11.92	-0.17	-3.25	-8.07	18.09 *	0.64	-6.71	8.94 *
47.	Panvel 1 x Kala Rata	30.66 **	14.81 *	27.39 **	26.59 **	9.99	24.66 **	18.63 **	12.34	44.31 **	25.35 **	12.43 **	31.28 **
48.	Panvel 1 x IR 76346-B-B-10-1-1-1	20.47 **	14.95 *	27.54 **	13.45 *	7.45	21.79 **	-2.12	-2.81	26.63 **	10.80 **	7.31	25.30 **
	Positive	35	12	27	24	8	27	21	12	36	33	18	40
	Negative	1	4	1	4	7	3	4	7	2	4	7	3
	Maximum	38.36	19.05	36.93	33.87	22.56	44.09	37.37	35.42	75.41	26.43	19.87	49.91
	Minimum	-16.65	-23.50	-13.93	-35.94	-40.30	-26.69	-40.90	-46.34	-23.98	-20.92	-28.99	-11.03
	S.E.±	1.16	1.34	1.34	1.29	1.49	1.49	1.24	1.43	1.43	0.72	0.83	0.83
	C.D. at 5 %	2.31	2.67	2.67	2.57	2.97	2.97	2.47	2.85	2.85	1.42	1.64	1.64
	C.D. at 1 %	3.06	3.53	3.53	3.40	3.93	3.93	3.27	3.77	3.77	1.87	2.16	2.16

*, ** Significant at 5 and 1 per cent probability levels, respectively.