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Estimation of Genetic Variability Parameters in Soft Rice (*Oryza sativa* L.) Genotypes

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A B S T R A C T

In the present investigation, seventy five speciality rices called soft rice genotypes collected from different parts of North-East India (especially Assam) were evaluated to estimate the genetic parameters in the experimental material for selection of the diverse parents among the genotypes for yield and component traits. The experiment was laid out in a randomized block design with three replications at Directorate of Rice Research Farm, ICRISAT Campus, Patancheru, Hyderabad, India. Analysis of variance indicated the existence of significant genotypic differences among the genotypes for the yield and its components traits for all the characters. High GCV and PCV values were observed for seed yield per plant, number of tillers per plant and number of productive tillers per plant, moderate GCV and PCV for plant height, panicle length, per cent filled grains per panicle and test weight. The values were low for days to 50% flowering and days to maturity. High heritability coupled with high genetic advance as percent of mean was observed for plant height, number of tillers per plant, number of productive tillers per plant, per cent filled grains per panicle, seed yield per plant and test weight, which indicated that these traits were controlled by additive type of gene action, indicating that these characters are more reliable for effective selection.

Introduction

Rice (*Oryza sativa* L. 2n: 2X: 24) is the most important cereal crop cultivated widely in many parts of the world. Over two billion people in Asia alone derive 80% of their energy needs from rice which contains 80% carbohydrates, 7-8% protein and also fat and dietary fiber (Juliano, 1985). Out of the 24 species of rice, 22 species are wild and only 2 species are cultivated i.e., *O. sativa* and *O. glaberima*. It is one of the very few crop species endowed with rich genetic diversity which account over one lakh landraces and improved cultivars (Samal *et al.*, 2014).

Genetic variability is the basic requirement for making progress in crop breeding. Inclusion of genetically divergent parents in any breeding programme is essential to create new genetic stocks. Genetic variability is the most important tool in the hands of the plant breeder in choosing the right type of parents for hybridization programme.

India has a rich source of genetic diversity for rice. The north-east region of India is a veritable natural gene bank representing wide spectrum of rice genetic resources. Among the different classes of rice available, glutinous / waxy rice is an important class, in the sense of being glue-like or sticky. The waxy rice of Assam has been classified in two groups *viz.*, *Bora* (glutinous) and *Chokuwa* (Semi-glutinous) based on amylose content (Shaptadvipa and Sarma, 2009). Bora rice of Assam has significance in social and religious ceremonies and forms a popular daily breakfast diet in rural Assam. Chokuwa (soft rice), is another class of rice used for instant preparations. This class of rice is not known in any other parts of the world. Its preparations are very popular in community feasts and festivals in Assam. "Soft rice (komal chawl)" are prepared from this class of rice by soaking the rice either in cold or hot water for a brief period of time and then consumed with sugar or molasses, milk or curd and even with salts and oils and pickles. These preparations seem to be useful for sailors, travelers, space researchers, mountaineers, defense personal etc. Thus this class of rice is metaphorically termed as "magical rice" as it becomes ready to use just by soaking with no fuel requirement and hence it has a great demand in the domestic as well as foreign market. The multiplicities of uses make the glutinous rice very popular among farmers. Inspite of the advent of modern high yielding rice varieties, these soft rices being mostly landraces are highly valuable and possess traits that are most prefered by farmers. The field trials of these varieties were already positive, suggesting that it could be grown in different climates across India. Therefore we focused attention towards the improvement of both quality and yield potential of these soft rices to fetch high premium price in the market.

In addition to studies on mean performance, the evaluation of material for genetic variability parameters among various yield and quality traits would be more useful to the plant breeders. Parents identified on the basis of divergence for any breeding programme would be more promising (Arunachalam, 1981). Information on coefficient of variation is useful in measuring the range of variability present in the characters. Hence total varience should be partitioned in to heritable and non-heritable components to assess the true breeding nature of the particular trait under study. Similarly, heritability is the measure of transmission of characters from generation to generation and the estimates of heritability will be of immense help to the breeder in selecting superior individuals for a desired trait and successfully utilizing them in breeding programme.

Research in this direction on soft rice has been initiated and efforts are made by the Directorate of Rice Research for collection of these soft rice germplasm and land races. At present some of the lines of this soft rice are available at Directorate of Rice Research. So far not much work has been done on genetic parameters of these soft rice genotypes. The systemic study of genetic analysis in the material is meagre. Hence, keeping in view the importance of soft rices and scanty literature on these aspects, the present investigation was undertaken as a first attempt in the state of Andhra Pradesh with the objective of estimating the genetic parameters like PCV, GCV, Genetic Advance and Heritability of these soft rice genotypes for selection of parents with desirable traits for any breeding programme.

Materials and Methods

Present investigation was conducted at the Directorate of Rice Research Farm, ICRISAT Campus, Patancheru, Hyderabad, India. Seventy five soft rice genotypes were studied to estimate the genetic variability parameters

like PCV, GCV, Genetic Advance and Heritability. The experiment site is geographically situated at 17.5°N latitude and 78.27°E longitude with an altitude of 545 metres above the sea level. The experiment was laid out in a Randomized Block Design with three replications during the season. Thirty days old seedlings were transplanted at the rate of one seedling per hill in three rows of five metre length with plant to plant distance of 15 cm and row to row distance of 20 cm. The standard cultivation practices prescribed for rice under irrigated conditions were followed precisely.

The experimental material consist of seventy five soft rice genotypes obtained from the germplasm collections maintained at Directorate of Rice Research, Rajendranagar, Hyderabad and these genotypes were primarily collected from the north eastern region of Assam. The soft rice lines were given the notation as SR and the names of these soft rices were mentioned in table 1. Five random plants were selected from central rows and the data was recorded in each replication on these five plants on nine yield components like Days to fifty per cent flowering, Plant height, Number of tillers per plant, Number of productive tillers per plant, Panicle length, Percent filled grains per panicle, Days to maturity, Seed yield per plant (g) and Test weight (g). The mean values with respect to these characters were subjected to the analysis like Analysis of variance, Genotypic and phenotypic coefficients of variation, Heritability and genetic advance with the help of standard statistical procedures.

Results and Discussion

The pooled analysis of variance revealed highly significant differences among the 75 genotypes for all the traits indicating presence of considerable genetic variation in the experimental material. The mean values for nine yield components for 75 soft rice genotypes are given in Table 2 and the results of analysis of variance are presented in Table 3. The genotypic and phenotypic coefficients of variation, heritability, genetic advance and genetic advance as percent of mean were estimated for 75 genotypes and are furnished in Table 4 and represented in Figure 1.

In the present investigation, the genotypic and phenotypic coefficients of variation were low for days to 50% flowering and days to maturity. Similar results were reported by Karim *et al.,* (2007), and Kole *et al.,* (2008) for days to 50% flowering and Balan *et al.,* (1999) and Karim *et al.,* (2007) for days to maturity.

The moderate GCV and PCV values observed for the traits *viz.,* plant height, panicle length, per cent filled grains per panicle and test weight.

Only moderate GCV value observed for number of tillers per plant and number of productive tillers per plant. Only high PCV value observed for number of tillers per plant and number of productive tillers per plant. The results were in confirmity with Vange and Ojo (1997) for test weight and number of productive tillers, Nayak *et al.,* (2002) for plant height, panicle length and test weight, patil *et al.,* (2003) for plant height and Chaudary and Motiramani (2003) for number of productive tillers per plant.

The high GCV and PCV were observed for seed yield per plant. Similar findings were reported by Patil and Sarawgi (2005) and Mustafa and Elsheikh (2007) for number of filled grains per panicle and grain yield per plant, Jayasudha and Sharma (2010) and Tiwari *et al.,* (2011) for grain yield per plant.

Table.1 Details of soft rice genotypes used in the study

S. No.	Soft rice line number	Local name of the genotype during collection
1	SR-1	Joha bora
2	SR-2	Ranga bora
3	SR-3	Sungal bora
4	SR-4	Noldong bora
5	SR-5	Tegori bora
6	SR-6	Bongari bora
7	SR-7	Kola ampaki bora
8	SR-8	Bora-1
9	SR-9	Dadhora bora
10	SR-10	Chokura bora
11	SR-11	Sakoibhanu bora
12	SR-12	Kola bora
13	SR-13	Misiri chakua
14	SR-14	Boka chakua
15	SR-15	Ch-5 bora chakua
16	SR-16	Kagori chakura
17	SR-17	Kola boka chakura
18	SR-18	Haru chakua
19	SR-19	Boga chakua
20	SR-20	Lahi chakua
21	SR-21	Sam chakua
22	SR-22	Maju chakua
23	SR-23	Ham chakua
24	SR-24	Hampori chakua
25	SR-25	Malbhog
26	SR-26	Helochi
27	SR-27	Kalamdani
28	SR-28	Dadhora
29	SR-29	Aghoni bora
30	SR-30	Bhogali bora
31	SR-31	Abor bora
32	SR-32	Beji bora1
33	SR-33	Begun bora
34	SR-34	Boga bora1
35	SR-35	Boga bora 3

36	**SR-36**	**Bhat bora**
37	SR-37	**Bora 1**
38	SR-38	**Bora 3**
39	SR-39	**Bora 5**
40	SR-40	**Botia bora**
41	SR-41	**Bor malbhog**
42	SR-42	**Chakkua bora 1**
43	SR-43	**Chansep bora**
44	SR-44	**Chandra bora**
45	SR-45	**Danbori bora**
46	SR-46	**Fakkai bora**
47	SR-47	**Gela bora**
48	SR- 48	**Ghew bora 1**
49	SR-49	**Garu chakua bora 2**
50	SR-50	**Gomiri bora**
51	SR-51	**Naldang bora**
52	SR-52	**Helochi bora 1**
53	SR-53	**Helochi bora 2**
54	SR-54	**Aghoni**
55	SR-55	**Bhogali**
56	SR-56	**KMJ bora 56**
57	SR-57	**KMJ bora 53**
58	SR-58	**KMJ bora 51**
59	SR-59	**KMJ bora 41**
60	SR-60	**KMJ bora 36**
61	SR-61	**KMJ bora49**
62	SR-62	**KMJ bora 74**
63	SR-63	**KMJ bora 5**
64	SR-64	**KMJ bora 13**
65	SR-65	**KMJ bora 21**
66	SR-66	**KMJ bora 25**
67	SR-67	**Boka chakua 1**
68	SR-68	**Boka chakua 2**
69	SR-69	**Kajoli chakua**
70	SR-70	**Kalamdani chakua**
71	SR-71	**Lahi chakua1**
72	SR-72	**Maju chakua 1**
73	SR-73	**Maju chakua 2**
74	SR-74	**Misiri chakua**
75	SR-75	**Sam chakura**

Table.2 Mean performance of 75 soft rice genotypes for yield and its component traits

S. No	Genotypes	Days to 50% flowering	Plant height (cm)	Number of tillers per plant	Number of Productive tillers per plant	Panicle length (cm)	Per cent filled grains per panicle	Days to maturity	Seed yield per plant (g)	Test weight (1000 grain) (g)
1	Joha bora	111.00	136.00	19.00	15.33	27.90	62.72	139.00	17.35	14.50
2	Ranga bora	114.66	119.16	16.00	14.00	24.16	96.79	146.33	14.64	26.73
3	Sungal bora	115.00	103.46	12.33	11.33	28.60	87.54	145.00	23.24	24.33
4	Noldong bora	117.33	103.06	18.00	15.00	31.80	84.86	145.33	23.44	27.06
5	Tegori bora	116.66	112.46	15.33	13.66	24.86	88.63	145.00	25.93	27.00
6	Bongari bora	110.00	96.50	15.00	12.66	26.53	98.09	139.66	28.99	24.45
7	Kola ampakhi bora	119.66	106.66	14.33	9.00	23.86	87.57	147.00	17.90	21.50
8	Bora-1	111.66	108.40	26.33	22.66	25.60	66.41	143.00	25.54	26.40
9	Dadhora bora	110.00	105.00	18.00	12.66	25.23	86.53	141.00	29.48	27.00
10	Chokua bora	116.66	110.60	18.00	15.00	29.80	76.54	144.00	15.97	25.00
11	Sakoibhanu bora	111.00	115.50	18.33	15.33	25.13	96.31	139.66	14.05	22.33
12	Kola bora	123.00	142.26	15.00	14.00	27.53	91.70	152.33	11.00	21.00
13	Misiri chokura	120.66	130.93	15.00	13.33	26.73	83.28	149.66	23.26	23.33
14	Boka chokura 2	107.66	112.06	17.66	17.33	25.33	82.06	139.33	13.33	25.83
15	Ch-5 bora chokura	111.66	116.73	18.00	16.66	24.46	81.73	140.33	12.92	25.50
16	Kajori chokura	110.66	121.46	13.66	12.66	30.66	97.51	141.66	25.92	23.15
17	Kola boka chokua	114.33	118.20	14.66	11.66	27.90	85.42	147.00	16.70	23.53
18	Haru chokua	112.33	114.63	14.33	12.66	26.00	85.48	137.00	16.88	33.16
19	Boga chokura	115.33	108.20	15.00	14.33	30.56	86.87	142.33	12.06	25.00
20	Lahi chokura	114.00	102.46	15.00	11.00	22.33	93.11	141.00	25.97	32.76
21	Sam chokura	117.00	72.56	21.66	20.00	23.80	90.50	149.66	13.85	23.66
22	**Maju chokura**	116.33	**116.20**	**18.66**	**12.33**	**24.93**	**93.43**	**143.00**	**18.35**	**24.40**

S. No	Genotypes	Days to 50% flowering	Plant height (cm)	Number of tillers per plant	Number of Productive tillers per plant	Panicle length (cm)	Per cent filled grains per panicle	Days to maturity	seed yield per plant (g)	Test weight (1000 grain) (g)
23	Ham chokura	107.66	79.73	11.33	10.00	30.03	75.80	136.00	13.70	**21.66**
24	Hampori chakua	112.33	117.73	12.33	11.00	30.60	72.19	144.00	21.64	**32.16**
25	Kasturi	111.00	110.73	15.33	15.33	27.93	93.11	141.33	15.67	**25.33**
26	Vasumati	110.00	82.26	12.00	13.00	27.73	76.28	139.66	9.54	**21.43**
27	Vikas	111.00	76.46	11.33	11.00	24.46	94.93	143.66	13.79	**24.13**
28	Jaya	111.66	75.86	18.66	16.00	23.46	87.68	140.33	17.43	**26.40**
29	Aghoni bora	119.66	75.73	17.00	14.66	26.26	73.72	151.00	29.82	**23.00**
30	Bhogali bora	119.66	78.46	19.00	17.00	24.53	84.99	152.33	16.25	**25.00**
31	Abor bora	113.00	105.00	22.33	16.33	28.40	81.38	142.66	12.88	**24.00**
32	Beji bora1	115.00	130.26	17.00	13.66	28.46	90.04	145.33	16.96	**23.66**
33	Begun bora	112.00	115.43	19.66	17.00	27.20	95.14	141.00	21.01	**25.66**
34	Boga bora-1	114.00	117.66	17.66	15.00	26.56	75.32	141.66	13.71	**30.66**
35	Boga bora -3	124.00	110.33	17.66	15.66	26.36	90.77	151.66	26.32	**28.00**
36	Bhat bora	123.66	129.60	17.00	15.00	24.4	76.82	151.00	25.67	**24.00**
37	Bora 1	122.33	125.93	11.00	10.33	27.73	71.57	149.66	12.05	**24.33**
38	Bora 3	130.33	105.33	12.33	12.33	25.40	35.40	159.66	25.57	**21.00**
39	Bora 5	112.00	115.53	23.66	20.33	29.36	81.36	142.00	17.50	**23.66**
40	Botia bora	113.33	131.06	22.66	20.66	33.60	95.64	142.66	19.86	**27.66**
41	Bor mulbhog	115.00	101.00	18.66	16.66	33.20	80.82	145.00	23.93	**22.66**
42	Chakua bora 1	112.33	121.93	19.0	17.66	23.53	92.55	142.66	15.91	**24.33**
43	Chansep bora	111.00	122.26	9.66	8.66	27.00	78.93	141.33	16.14	**27.00**
44	Chandra bora	111.66	115.33	17.00	15.00	25.76	85.92	141.66	23.34	**23.00**
45	**Danbori bora**	115.00	**110.33**	**19.66**	**16.66**	**27.46**	**76.21**	**145.00**	**16.07**	**21.33**

S. No	Genotypes	Days to 50% flowering	Plant height (cm)	Number of tillers per plant	Number of Productive tillers per plant	Panicle length (cm)	Per cent filled grains per panicle	Days to maturity	seed yield per plant (g)	Test weight (1000 grain) (g)
46	Fakial bora	111.00	107.00	18.33	17.33	25.40	97.96	139.33	11.30	**23.66**
47	Gella bora	120.00	122.40	13.66	11.66	24.46	91.49	147.66	21.52	**21.66**
48	Ghew bora 1	122.33	128.20	16.00	14.66	29.33	77.45	150.33	15.38	**25.66**
49	Garu chakua bora 2	112.33	116.80	14.66	13.66	30.60	86.02	139.00	19.75	**25.66**
50	Gomiri bora	113.66	116.60	11.00	12.00	29.50	90.41	144.00	13.62	**25.66**
51	Naldang bora	113.66	119.53	15.00	14.33	21.73	90.05	141.00	26.36	**25.50**
52	Helochi bora 1	113.66	131.73	14.66	15.00	30.26	66.05	143.00	14.63	**26.73**
53	Helochi bora 2	118.33	125.20	17.66	16.00	27.56	84.46	146.00	17.68	**21.00**
54	Aghoni bora	122.00	75.73	17.00	15.66	24.86	81.51	151.00	16.60	**23.66**
55	Bhogali bora	119.66	70.00	16.33	15.00	21.46	95.40	149.00	18.06	**23.00**
56	KMJ bora 56	119.33	126.96	16.00	12.00	30.53	86.30	149.00	21.86	**24.00**
57	KMJ bora 53	118.00	108.00	11.00	10.33	24.00	91.43	147.00	14.30	**21.00**
58	KMJ bora 51	118.33	138.26	16.00	14.00	27.00	86.63	146.00	21.20	**31.00**
59	KMJ bora 41	120.00	115.33	17.00	15.33	27.80	89.80	149.000	19.20	**19.00**
60	KMJ bora 36	123.33	106.00	23.00	19.33	26.13	70.60	153.33	8.56	**20.66**
61	KMJ bora 49	121.33	125.53	13.33	11.33	24.93	86.88	151.33	19.20	**23.00**
62	KMJ bora 74	111.33	114.33	17.66	13.33	27.06	87.73	141.66	22.49	**22.83**
63	KMJ bora 5	111.33	129.73	16.33	15.33	32.96	83.33	141.66	24.65	**26.16**
64	KMJ bora 13	116.33	122.93	13.33	13.66	24.86	80.83	148.00	21.46	**24.60**
65	**KMJ bora 21**	**116.00**	**120.06**	**14.00**	**13.00**	**30.33**	**61.28**	**149.00**	**13.61**	**22.33**

S. No	Genotypes	Days to 50% flowering	Plant height (cm)	Number of tillers per plant	Number of Productive tillers per plant	Panicle length (cm)	Per cent filled grains per panicle	Days to maturity	seed yield per plant (g)	Test weight (1000 grain) (g)
66	KMJ bora 25	117.66	121.20	16.33	13.33	22.10	66.41	149.33	17.86	**23.00**
67	Boka chakua 1	122.00	126.16	19.00	13.66	28.00	77.43	150.66	22.50	**23.93**
68	Boka chakua 2	115.00	122.60	15.33	11.00	25.06	45.31	142.33	19.90	**24.13**
69	Kajoli chakua	109.66	109.60	14.66	12.66	32.46	94.58	139.00	21.28	**23.00**
70	Kalamdani chakua	110.00	101.33	16.00	15.00	30.90	82.08	140.33	18.33	**27.00**
71	Lahi chakua	110.33	112.66	19.33	15.66	32.20	98.40	139.66	21.20	**27.50**
72	Maju chakua 1	110.33	103.06	16.33	14.00	29.73	95.70	139.00	21.54	**27.60**
73	Maju chakua 2	113.66	104.93	12.33	11.66	18.30	89.27	142.33	21.78	**25.00**
74	Misiri chakua	124.00	121.26	21.00	19.33	25.66	94.71	152.00	21.17	**21.00**
75	Sam chakua	114.00	114.80	17.33	13.00	27.40	96.56	146.33	24.33	21.00
	Mean	115.37	111.79	16.41	14.32	27.01	83.94	144.76	18.97	24.50
	C.V (%)	1.39	2.11	6.90	9.44	6.48	1.07	0.81	5.31	4.18
	S.E±	0.93	1.36	0.65	0.78	1.01	0.51	0.68	0.58	0.59
	C.D at 5%	2.60	3.82	1.82	2.18	2.82	1.45	1.90	1.62	1.65
	C.D at 1%	3.43	**5.04**	**2.41**	**2.88**	**3.73**	**1.91**	**2.52**	**2.14**	2.18

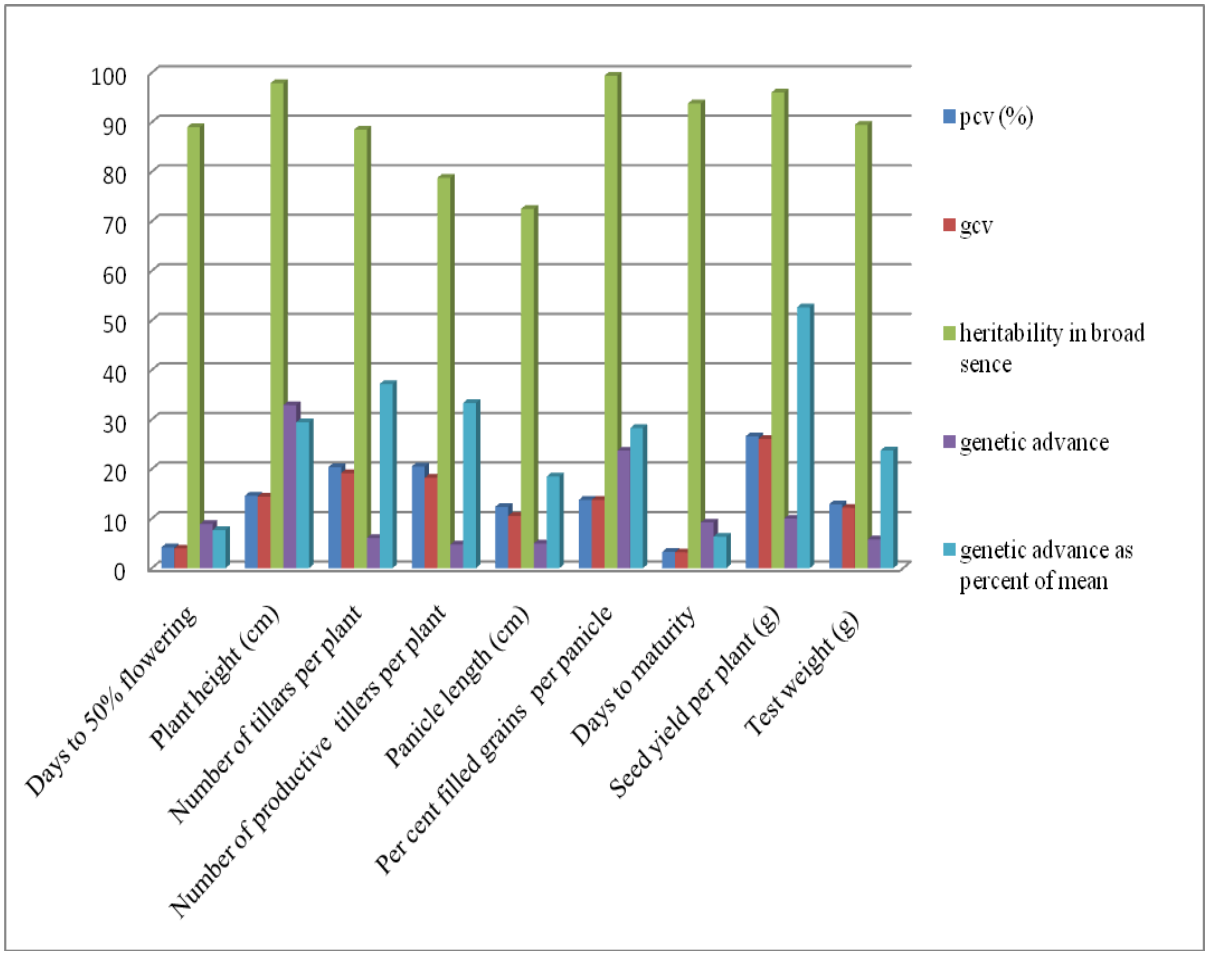
Table.3 Analysis of variance for grain yield and its components traits in soft rice genotypes

S. No.	Character	Mean sum of squares		
		Replications (d.f=2)	Treatments (d.f=74)	Error (d.f=148)
1.	Days to 50% flowering	3.29	65.53**	2.6
2.	Plant height (cm)	15.49	788.20**	5.61
3.	Number of tillers per plant	12.41**	31.02**	1.28
4.	Number of productive tillars per plant	19.24**	22.29**	1.83
5.	Panicle length (cm)	5.30	27.40**	3.07
6.	Per cent filled grains per panicle	5.93**	401.25**	0.80
7.	Days to maturity	12.65**	65.43**	1.40
8.	Seed yield per plant	0.15	74.51**	1.01
9.	Test weight (gm)	5.75**	27.84**	1.05

Table.4 Estimates of variability, heritability (broad sense), genetic advance and genetic advance as per cent of mean for grain yield and its components in soft rice genotypes

S. No.	Character	Range	PCV (%)	GCV (%)	Heritability in Broad sense (h^2_{bs}) (%)	Genetic Advance Per cent (at 5%)	GA as per cent ofmean (at 5%)
1.	Days to 50% flowering	107.66-130.33	4.20	3.97	89.0	8.9	7.71
2.	Plant height (cm)	70.00-142.26	14.60	14.44	97.9	32.91	29.44
3.	Number of tillars per plant	9.66-26.33	20.38	19.18	88.5	6.10	37.18
4.	Number of productive tillers per plant	8.66-22.66	20.53	18.23	78.8	4.77	33.36
5.	Panicle length (cm)	18.30-33.60	12.38	10.54	72.5	4.99	18.49
6.	Per cent filled grains per panicle	35.40-98.40	13.80	13.76	99.4	23.72	28.26
7.	Days to maturity	136.00-159.66	3.29	3.19	93.8	9.22	6.36
8.	Seed yield per plant (g)	8.56-29.82	26.62	26.08	96.0	9.99	52.65
9.	Test weight (g)	14.50-33.16	12.89	12.19	89.5	5.82	23.76

Fig.1 Variability, heritability, genetic advance, genetic advance as per cent of mean in soft rice



The estimates of heritability act as predictive instrument in expressing the reliability of phenotypic value. Therefore, high heritability helps in effective selection for a particular character. The genetic advance is a useful indicator of the progress that can be expected as a result of exercising selection on the pertinent population.

The heritability estimates were high for all the traits viz., days to 50% flowering, plant height, number of tillers per plant, number of productive tillers per plant, panicle length, per cent filled grains per panicle, days to maturity, seed yield per plant and test weight (1000- grain weight). These are in conformity with Patil *et al.,* (2003) for all the characters, Hasib *et al.,* (2004) for all quantitative characters, Saxena *et al.,* (2005) for plant height, panicle length, number of filled grains per panicle and 1000- grain weight, Madhavilatha *et al.,* (2005a) for number of filled grains per panicle, grain yield per plant, Sarkar *et al.,* (2005) for 1000-grain weight, Nayudu *et al.,* (2007) for number of productive tillers per plant, panicle length, number of filled grains per panicle, 1000-grain weight and grain yield per plant. High heritability for quantitative characters indicates the scope of genetic improvement of these characters through selection.

Genetic advance was high for the traits plant height and per cent filled grains per panicle where as low for the traits days to 50% flowering, number of tillers per plant, number

of productive tillers per plant, panicle length, days to maturity, seed yield per plant and test weight (1000-grain weight). Similar results were reported by Satyanarayana *et al.*, (2005) for plant height and 1000-grain weight, Sarkar *et al.,* (2005) for number of filled grains per panicle, Karad and Pol (2008) for plant height. High heritability with high genetic advance indicates the control of additive gene and selection may be effective for those characters.

Genetic advance as percent of mean was high for plant height, number of tillers per plant, number of productive tillers per plant, per cent filled grains per panicle, seed yield per plant and test weight (1000-grain weight). It was moderate for the trait panicle length and it was low for days to 50% flowering and days to maturity. These results are in conformity with Nayudu *et al.,* (2007) for number of productive tillers per plant, panicle length, per cent filled grains per panicle, 1000 -grain weight and grain yield per plant.

The knowledge of genetic variability present in a given crop species for the character under improvement is of paramount importance for the success of any plant breeding programme. Information on coefficient of variation is useful in measuring the range of variability present in the characters. Hence total varience should be partitioned in to heritable and non-heritable components to assess the true breeding nature of the particular trait under study.

Besides genetic variability, knowledge of heritability and genetic advance measures the relative degree to which a character is transmitted to progeny, thereby helping the breeder to employ a suitable breeding strategy to achieve the objective faster. Heritability and genetic advance are important selection parameters. Genotypic coefficient of variation (GCV) along with heritable estimates would provide a better picture of the amount of genetic advance to be expected by phenotypic selection. It is suggested that genetic gain should be considered in conjunction with heritability estimates. Heritability estimates along with genetic advance are normally more helpful in predicting the gain under selection than heritability estimates alone and thereby enabling the selection of most potential genotype.

In the present investigation, Analysis of variance indicated highly significant differences among the genotypes for all the traits under study. A perusal of genetic variability parameters revealed that phenotypic and genotypic coefficients of variation were high for seed yield per plant, number of tillars per plant and number of productive tillars per plant. The phenotypic and genotypic coefficients of variation were moderate for plant height, panicle length, per cent filled grains per panicle and test weight. The values were low for days to 50% flowering and days to maturity.

High heritability coupled with high genetic advance as percent of mean was observed for plant height, number of tillars per plant, number of productive tillers per plant, per cent filled grains per panicle, seed yield per plant and test weight (1000-grain weight), which indicated that these traits were controlled by additive type of gene action. The high estimates of heritability coupled with low genetic advance as percent of mean for days to 50% flowering and days to maturity indicated the presence of non-additive gene effects, in addition to influence of environment to some extent. Thus evaluation of material for genetic variability parameters among various yield and quality traits would be more useful to the plant breeders and parents identified on the basis of these parameters for any breeding programme would be more promising.

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