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GENETIC STUDIES FOR YIELD AND COMPONENT TRAITS IN WORLD MINI CORE RICE COLLECTIONS UNDER SODIC SOILS

V.K. Yadav, S.K. Soni, Devendra Singh and Mahipat Singh[1]

Deptt. of Genetics and Plant Breeding, C.S.A. Univ. of Agric. and Tech., Kanpur-208002 (U.P.)

[1]Deptt. of Seed Science and Technology, Bundelkhand University, Jhansi (U.P.)

ABSTRACT

Sixty four rice lines were grown at Crop Research Farm, Nawabganj, C.S. Azad Univ. of Agril. and Tech., Kanpur (U.P.) India in augmented randomized block design during Kharif 2009 for the study on seven quantitative traits. Highest genotypic as well as phenotypic coefficient of variation was observed for grain yield plant-1. Number of grains panicle-1 followed by plant height, days to heading, and spikelet fertility expressed high estimate of both heritability and genetic advance. Highly positive and significant correlation was observed between grain yield and number of grains panicle-1, spikelet fertility, and productive tillers plant-1. Number of grains panicle-1 followed by spikelet fertility, productive tillers plant-1 and plant height were significant and positively correlated, also emerged as direct contributors which would be utilized for selection criteria in breeding programme to develop high yielding cultivars with desirable traits.

Key words : *Variability parameters, correlation, path, salt tolerance and desirable plant type*

Rice (*Oryza sativa* L.) is the life line of majority of Asian population and interwoven in their social-cultural lives. More than 90 per cent of the global production and consumption of rice is in Asia. Based on the current rate of population growth, the projected demand of rice would be 130.o m.tonnes by year 2025. The production has to be increased at the rate of 2 m. tonnes per annum to meet the future requirement. This projected demand has to be met under numerous biotic and abiotic stresses which limit the rice production to exploit its full potential. Among abiotic stresses, soil salinity and alkalinity is a major one, as about 30 per cent of the total rice cultivated area worldwide has too high salt level to allow normal rice yield (1).

A soil is considered sodic when the sodium ion concentration reaches a critical point that starts to affect soil structure and check the life cycle of plant and survival. The problem is serious in heavily irrigated inland particularly in canal irrigated areas of central Uttar Pradesh. The most efficient, economically feasible and environmentally safe option to combat the salinity- alkalinity is to develop varieties with higher yield and inbuilt tolerance to salt stress. To evolve rice varieties having salt tolerance and high yield, it becomes necessary to study the extent of variability available in world mini core collections. The knowledge of variability exist in a crop species has special significance to achieve the success in any crop improvement program for targeted environment. The effectiveness of selection depends on magnitude and desirable direction of genetic variability. Inquisition of interrelationship among economic output and its contributing traits is also desirable for efficient selection of genotypes in a site specific environment. This is very important to measure the traits which affect grain yield positively or negatively. A positive correlation between two desirable traits makes the business of the plant breeder easy for improving both traits simultaneously.

MATERIALS AND METHODS

A total of 64 rice genotypes including four checks viz. Jaya, CSR-36, Nonabokra, Usar dhan-3 were evaluated in Augmented Randomized Block Design during kharif 2009 at Crop Research Farm, Nawabganj, C.S. Azad University of Agriculture and Technology, Kanpur (UP) India sourced from genetic resource pool and World Core Collection exist in Rice Improvement Project. Each genotype was grown in three-row of 3 m length following row to row and plant to plant spacing of 20 cm and 15 cm, respectively. The recommended dose of fertilizers N:P:K @ 120:60:60 and cultural practices were followed to raise a healthy crop. The site of experiment was salt affected clay loam

(Typic Natrustalf) soil having pH = 10.4, EC =2.03, ESP=72.3 (meq/100g) and low in organic carbon, nitrogen and phosphorus. The observations were taken on eight randomly selected plants per genotype for days to heading, plant height, productive tillers per plant, panicle length, number of grains per panicle, spikelet fertility and grain yield per plant. The biometrical tools and techniques were followed according to estimation of genotypic and phenotypic coefficients of variation (2), heritability in broad sense (4) and genetic advance (Johnson et al., 1955), character association (5) and path by (6).

RESULTS AND DISCUSSION

The analysis of variance revealed significant mean sum of squares for all the traits except plant height and productive tillers/plant. The variance due to overall performance of genotypes under mini core collections was significant for all the character under study while the variances due to check varieties observed highly significant for all the traits except for plant height, productive tillers/plant, number of grains/panicle and grain yield/plant. The data on mean values, range and coefficient of variation heritability and genetic advance for the characters studied are presented in Table-2.

Phenotypic coefficient of variability (PCV) was higher than genotypic coefficient of variability (GCV) for all the traits. These traits exhibited higher variation for GCV and PCV across the environment. A similar result was also reported by Khedikar et al., 2003. Higher order of PCV and GCV were observed for grain yield/plant (36.88 and 25.92) followed by number of grains/panicle (25.84 and 25.16), productive tillers/plant (24.99 and 22.16) and plant height (20.32 and 17.80) which are in conformity with the results of (7, 8). To meet the goal of breeding location specific genotypes, besides yield, a wide rang of other yield contributing traits are very much essential which enable plant breeder to exploit full genetic potential of the the crop under the targeted environment. Moderate PCV and GCV was expressed by spikelets/panicle (16.63 and 15.93) while very low to low order of variation was recorded for days to heading and spikelet fertility.

The high estimates of broad sense heritability and genetic gain was recorded for number of grains/panicle (94.79 and 71.36), followed by plant height (76.71 and 10.40) days to heading (92.03 and 11.02), and spikelets fertility (76.51 and 32.39). Effectiveness of selection is influenced by the magnitude of heritability and genetic advance. Moderate estimate of heritability and genetic advance observed for grain yield in this study corroborates well with the results of (9). Moderate heritability estimates for grain yield reflects that the environmental effects constitute a considerable portion of total phenotypic variation. Thus, the selection for superior genotypes on the basis of yield per se may not be highly effective. Therefore, fore a more efficient improvement on grain yield selection in sodic soils of central U.P. should be made on components of grain yield.

Correlation and path coefficient are presented in Tables 3 and 4 respectively. Grain yield was most strongly associated with number of grains/panicle (0.861), spikelet fertility (0.646) and productive tillers/plant (0.378) indicated the importance of these

Table-1: Mean squares of 7 different characters in salt tolerance rice**.**

Source of variation	DF	Days to heading	Plant height (cm)	Productive tillers/ plant	Panicle length	No. of grains/ panicle	Spikelet fertility (%)	Grain yield. plant (g)
Block	3	102.61**	178.51	8.22	14.58*	6742.72**	63.16	34.75**
Treatment	63	31.74**	128.96**	5.34**	8.13**	1283.14**	35.87**	10.21**
Germplasm	59	25.51**	128.32**	5.22	6.37**	1248.49**	31.73	8.95**
Check	3	115.41**	105.72	1.58	32.93**	216.89	128.25**	7.24
Check vs Treatment	1	148.83	237.01	24.07	37.35	6526.05	3.43	45.67
Error	9	2.69	36.39	1.36	0.71	69.51	10.23	8.33

* , ** significant at 5% and 1% level of probability, respectively.

Table-2: Variability and selection parameters for different traits in salt tolerance rice.

Characters	Range		Grand mean	PCV	GCV	h^2 (b)	GA	GA % of mean
	Min.	Max.						
Days to heading	100.00	121.00	112.93	5.14	4.94	92.03	11.02	9.75
Plant height (cm)	38.00	100.00	61.51	20.32	17.80	76.71	19.75	32.11
Productive tillers/plant	6.00	15.00	10.09	24.99	22.16	78.62	4.08	40.48
Spikelets/panicle	12.00	23.00	17.70	16.63	15.93	91.80	5.57	31.45
No. of grains/panicle	88.00	210.00	141.39	25.84	25.16	94.79	71.36	50.47
Spikelet fertility (%)	67.00	90.40	79.28	8.32	7.28	76.51	10.40	13.12
Grain yield/plant (g)	4.60	17.20	11.00	36.88	25.92	49.38	4.13	37.52

Table 3: Correlation matrix for different characters in salt tolerance rice.

Characters	Days to heading	Plant height (cm)	Productive tillers/ plant	Spikelets/ panicle	No. of grains/ panicle	Spikelet fertility (%)	Grain yield/plant (g)
Days to heading	1.000	-0.002	-0.202	-0.222	0.0311	-0.052	-0.115
Plant height (cm)		1.000	0.049	0.315**	-0.116	0.026	-0.0027
Productive tillers/plant			1.000	0.424**	0.361**	0.052	0.378**
Spikelets/panicle				1.000	0.078	0.029	0.158
No. of grains/panicle					1.000	0.458**	0.861**

*, ** Significant at 5% and 1% levels, respectively.

Table 4: Path analysis for grain yield per plant in salt tolerance rice.

Characters	Days to heading	Plant height (cm)	Productive tillers/ plant	Spikelets/ panicle	No. of grains/ panicle	Spikelet fertility (%)	Correlation with grain yield/plant (g)
Days to heading	**0.053**	0.000	0.018	0.006	0.021	0.017	0.115
Plant height (cm)	0.000	**0.055**	0.004	0.009	0.079	0.008	0.0027
Productive tillers/plant	0.011	0.003	**0.089**	0.012	0.246	0.0170	0.378
Spikelets/panicle	0.012	0.017	0.038	**0.028**	0.054	0.009	0.158
No. of grains/panicle	0.001	0.006	0.032	0.002	**0.68**	0.148	0.861
Spikelet fertility (%)	0.002	0.001	0.004	0.008	0.313	**0.324**	0.646

Bold figures indicate direct effect, Residual factor = 0.1590

characters for enhancement of grain yield. Similar results were also reported by (10, 11). Spikelet fertility showed highly and positive association only with number of grains/panicle (0.458). Number of grains/ panicle was significantly and positively correlated with productive tillers/plant (0.361). Highly positive and significant correlation was noted between spikelet/ panicle and plant height (0.315), productive tillers/ plant (0.424) that can be increased simultaneously through selection of these component traits (Table-3).

Direct effect of number of grains/panicle (0.682), followed by spikelet fertility (0.324) productive tillers/ plant (0.089) and plant height (0.055) were positive, while only days to heading showed negative direct effect on grain yield/plant. Direct effect of number of grains/panicle, followed by spikelet fertility and productive tillers/plant were considerably higher Therefore, these three components can increase yield positively in this study conforms well with the results of (9). Indirect effect of productive tillers/plant, spikelets/ panicle, spikelet fertility via number of grains/panicle on grain yield was positive and high. This result indicated that number of grains/panicle, followed by spikelet fertility and productive tillers/plant had a great effect on grain yield.

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