



Characterization of Rice Germplasm of North Bihar for Panicle Morphology and Grain Characteristic Traits under Rainfed Lowland and Deep Water Condition

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ABSTRACT

A wide range of variation was observed in a set of 120 land races of rice genotypes of north Bihar for nine panicle morpho-grain characteristics traits. Majority of genotypes with intermediate panicle length, number of primary branches, number of grains per panicle, 1000-grain weight, L/B ratio, grain elongation and grain yield per plant. Larger number of genotypes with medium yield potential, having 110-140 grains per panicle. Head rice recovery ranged from 45-55 per cent in most of the genotypes. Estimates of coefficient of variation showed that variability in number of secondary branches (24.01%), number of primary branches (21.74%), number of grains per panicle (19.36%), L/B ratio (16.35), 1000-grain weight (14.21%) and grain elongation (7.49%). Based on the mean performances, the genotypes, viz.; TCA 88-42-2 and TCA 88-45 for panicle length, TCA 88-57-3 and TCA 88-51-3 for primary branches, TCA 95-2 and TCA 93-3 for secondary branches, TCA 88-2 and TCA 88-8-1 for number of grains per panicle, TCA 88-57-1 for head rice recovery, TCA 95-7 and TCA 88-47 for 1000-grain weight, TCA 98-1 and TCA 95-6 for L/B ratio, TCA 88-1 and TCA 98-7 for grain yield per plant and TCA 88-92-1 and TCA 88-42 for grain elongation were found best. The results of the characterization of different panicle morpho –grain characteristics traits would prove beneficial in formulating breeding program of lowland and deep water rice's and also for their utilization in other breeding programs.

Keywords: Characterization, panicle morphology and grain characteristics.

Rice is staple food for Indian subcontinent (Singh and Lal, 2007). Rice and or wheat are the main contributors for energy giving food for the humanity (Laik *et al.*, 2014). Bihar is a typical eastern state where rice is the main food crop and grown all most all part of the state. It is mainly cultivated in kharif and is grown under diverse ecological conditions, the productivity is consequently poor. Most of the rainfed area is covered by traditional system of rice cultivation and managed by resource poor farmers. Rainfed low land including flood prone constitute more than 50 per cent of the total rice acreage in the state. Traditional cultivars in this situation show better performance consequently are preferred by farmers. These cultivars have poor grain yield potential and are susceptible to disease and pest, having lodging tendency. There is considerable scope of improving

yield of rice in Bihar provided a well-planned strategy is undertaken. There are hundreds of such local land races in the region which have not been characterized in detail. Although several reports on Bihar rice collection and evaluation are available, representation of this class of rice germplasm in them were very poor. In this context, it is essential to characterize the germplasm in detail. As a part of this present investigation was attempted to characterize a set of local land races of rice genotypes of north Bihar for different panicle morphological and grain characteristic traits. Screening selection of desired materials through characterization and evaluation is one of the best sustainable tools to develop suitable crop varieties for diverse agro climatic conditions (Singh *et al.*, 2008).

The materials for the present investigation consisted of 120 local land races of rice germplasm collected from lowland and deep water ecosystem procured from rice section, Department of Plant Breeding and Genetics,

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Rajendra Agricultural University, Pusa, Samastipur, Bihar. The genotypes were grown in an augmented randomized block design with check varieties viz.; Prabhat, Satyam, Rajshree and Sudha during kharif, 2000. Entries were grown in four rows, plots of 3m length. Twenty one day old seedlings were transplanted with spacing of 20cm x 15cm. Normal agronomic package of practices were followed to raise the crop. Observations were recorded on nine panicle morphological and grain characteristic traits viz.; panicle length (cm), number of primary branches, number of secondary branches, number of grains per panicle, head rice recovery (%), L/B ratio, 1000-grain weight (g), grain yield per plant (g) and grain elongation (%) following standard evaluation system for rice (IRRI, 1993). Frequency distributions for all the nine traits were computed. Observations on nine quantitative traits (Table 2) were subjected to analysis of variance of augmented design as per Federer (1956) and Chang and Bardenas (1965). The local land races of rice germplasm of north Bihar under study showed wide range of differences for all the panicle morpho-grain characteristics (morpho-agronomic) traits studied. Frequency distribution for all the traits is presented in Table 1. Range, mean (test genotypes), mean (checks) and variance computed for nine quantitative traits are presented in Table 2. Almost all the traits except head rice recovery (%) showed high frequency of genotypes in intermediate classes. Observation on panicle length revealed that was in between 21 cm to 27 cm in most of the varieties; few entries occupied extreme phenotypic classes. Only twelve had more than 27cm panicle length while, one genotype TCA88-44-2 showed 30.25cm panicle length. About 61.6% of the varieties exhibited 110-140 number of grains per panicle while, 20 genotypes had 140-170 grains per panicle and 12 had more than 170 grains per panicle.

Availability of long panicle length and high number of grains per panicles types is of significance in view of developing high yielding varieties. Variability in above trait was reported by Das *et al.* (1981) and Sarma *et al.* (2004). Observations on number of primary branches revealed that very few entries occupied extreme phenotypic classes; only 8 having less than 7 primary branches and 4 had more than 13 number of primary branches. Number of secondary branches was observed below 24 in most of that variety, while only five TCA88-70-1, TCA88-86-4, TCA88-99, TCA95-2, TCA93-3 showed more than twenty eight secondary branches (IRRI 1993).

Observation on head rice recovery percent revealed that majority of the germplasm was less than 60 percent,

Table 1: Frequency distribution of different panicle morphological and grain characteristics in rice

Traits	Phenotypic Classes	No. of genotypes	Percent of genotypes
Panicle length (cm)			
	18-21	16	13
	21-24	48	40.0
	24-27	43	35.8
	27-30	12	10.8
	30-33	01	0.8
No. of primary			
	5-7	08	6.6
Branches			
	7-9	39	32.5
	9-11	51	42.5
	11-13	18	15.0
	13-15	4	3.3
No. of secondary			
	12-16	35	29.1
Branches			
	16-20	36	30.0
	20-24	25	20.8
	24-28	19	15.8
	28-32	5	4.1
No. of grains per			
	90-110	14	11.6
Panicle			
	110-140	74	61.6
	140-170	20	16.6
	170-200	12	10.0
Head rice recovery (%)			
	45-50	43	35.8
	50-55	34	28.3
	55-60	31	25.8
	More than 60	12	10.0
1000-grain weight (g)			
	Less than 20	01	26.6
	20-24	0.8	40.0
	24-28	32	23.1
	28-32	48	9.0
	32-36	28	11
L/B ratio (mm)			
	Less than 2.0	5	4.1
	2.0-2.5	20	16.6
	2.0-3.0	71	59.1
	3.0-3.5	22	18.3
	3.5-4.0	2	1.6
Grain elongation (%)			
	85-100	3	2.5
	100-115	53	44.1
	115-130	60	50.0
	130-145	4	3.3
Grain yield per plant(g)			
	10-20	20	16.6
	20-30	96	80.0
	30-40	3	2.5
	More than 40	1	0.8

Table 2: Variability parameters for nine quantitative traits in rice germplasm of North Bihar

Traits	Range	Mean (Test Genotype)	Mean (check)	Variance
Panicle length (cm)	17.25-30.25	23.48	21.43	3.443
No. of primary branches	5-15	9.60	8.12	0.741
No. of secondary branches	12-32	19.49	4.822	24.01
No. of grains/panicle	90-200	136.36	85.183	19.36
Head rice recovery (%)	40-68	52.89	7.354	10.78
L/B ratio	1.71-3.77	2.69	0.014	16.35
1000-grain weight (g)	19.04-34.32	25.94	1.750	14.21
Grain elongation (%)	86.66-137.03	114.85	20.525	7.49
Grain yield/plant (g)	12.00-43.85	22.88	3.832	21.74

while 12 had exhibited more than 60 percent head rice recovery. L/B ratio was observed 2.5 to 3.0mm in 59.1% of the entries while, only twenty two germplasm had 3.0 to 3.5mm L/B ratio. Two genotype TCA88-15 and TCA95-6 exhibited more than 3.5mm L/B ratio. Observations on 1000-grain weight revealed that majority of the entries exhibited 20 to 32g, while, eleven genotypes showed more than 321g. Genotypes were observed to be medium yielders. Grain yield per plant varied from 12.00 to 43.85gm. Most of the varieties exhibited 20 to 30gm grain yield per plant. While, four of them exhibited more than 30gm grain yield per plant were TCA88-1, TCA88-3, TCA88-2 and TCA98-7. Variability in this trait was also reported by Goswami (2000) and Sarma *et al.* (2004). The genotypes also differed with respect with respect to grain elongation percent. Most of the entries were in between 100-130 percent grain elongation while, three genotypes exhibited less than 100 percent grain elongation and four genotypes TCA88-92-1, TCA88-42, TCA88-44-1 and TCA88-31-3. Grain elongation, which is an important character from farmer's acceptance point of view, was mostly intermediate to easy in nature. Based on the mean performance, the genotypes found best for various traits were, TCA88-44-2 and TCA88-45 for panicle length, TCA88-57-3 and TCA88-51-3 for number of primary branches, TCA95-2 and TCA93-3 for number secondary branches, TCA88-2 and TCA88-8-1 for number of grains per panicle, TCA88-57-1 for head rice recovery, TCA95-7 and TCA 88-47 for 1000-grain weight, TCA 98-1 and TCA95-6 for L/B ratio, TCA 88-1 and TCA 98-7 for grain yield per plant and TCA88-92-1 and TCA88-42 for grain elongation. Table 2, provides a comparative assessment of the variability with respect to nine quantitative traits. Significant variability was observed for all the nine traits studied. Wide range of variation was found for number of grains per panicle (90-200), grain elongation (86.66-137.03), grain yield

per plant (12.00-43.85g), head rice recovery percent (40-68), number of secondary branches (12-32), 1000-grain weight (19.04-34.32g), panicle length (18.00-29.25cm), number of primary branches (5-15), L/B ratio (1.71-3.77). Phenotypic coefficient of variation was estimated for different traits with a view to compare relative variability of different traits present in the rice germplasm. Coefficient of variation was observed to be maximum for number of secondary branches (24.01) followed by number of primary branches (21.74), number of grains per panicle (19.36), L/B ratio (16.35mm), 1000-grain weight (14.21) and grain elongation (17.49 cm). These findings are in accordance with the results of Virmani (1979), Thakur *et al.* (1984), Jusu and Monde (1990), Baruah *et al.* (1994) and Sarma *et al.* (2004). Selection for these traits would, therefore, be comparatively more effective than the other having relatively less variation, in any plant breeding programme. Variability and selection are indispensable. Selection of plant breeding depends on the extent of variability present in the material and more the variability, better is the chance of selection. In the present investigation a wide range of variation was observed for yield and yield contributing traits.

CONCLUSION

The above results provided an overall picture of different panicle morphology and grain characteristic traits in land races of rice germplasm of north Bihar. Apart from this land races of rice are also know to possess stress tolerance ability. The results of the characterization of different panicle morpho-grain characteristics traits would provide beneficial in formulating breeding programme of lowland and deep water rice and also for their utilization in other breeding programmes.

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