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GENETIC PARAMETERS FOR QUANTITATIVE AND EARLY SEEDLING VIGOUR RELATED TRAITS IN RICE (*Oryza sativa* L.) UNDER DRY DIRECT SEEDED RICE CONDITIONS

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ABSTRACT

A study was conducted involving 40 rice genotypes for genetic variability of yield, yield attributes and early seedling vigour related traits under dry Direct Seeded Rice (DSR) conditions. The analysis of variance revealed significant differences for all the characters studied indicating the presence of considerable amount of variability among the genotypes. Phenotypic coefficient of variation was slightly higher than the corresponding genotypic coefficient of variation for all the traits under study. The characters *viz*., number of chaffy grains panicle^{-1}, 1000-grain weight, grain yield plant^{-1}, number of filled grains panicle^{-1} and seedling vigour index – II recorded high PCV, GCV, heritability (broad sense) and genetic advance as per cent of mean indicating that these characters were governed by additive gene action and simple selection would be more rewarding for their improvement.

KEYWORDS: Rice, dry DSR, heritability, genetic advance as per cent of mean, coefficient of variation.

INTRODUCTION

Rice (*Oryza sativa* L.) is the most important staple food crop. Rice is commonly cultivated by transplanting seedlings into the puddled soil. This transplanting method is water-intensive and labour-intensive and hence, less profitable. It leads to methane gas emissions as well and, hence, not eco-friendly; disturbs the physical properties of the soil thereby affecting the production of succeeding upland crops. These constraints necessitate a shift from puddled transplanting to Direct Seeded Rice (DSR). Direct seeding can be classified as (1) Wet-DSR, (in which sprouted seeds are broadcasted or sown in lines on wet soil), (2) Dry DSR, (where dry seeds are drilled or broadcasted on un puddled, dry soil). (3) Water seeding (where sprouted seeds are broadcasted in the standing water) (Mahender *et al*., 2015). Compared to wet and water DSR methods, dry DSR is more useful in many situations, as it involves less labour utilization, saves time to sow the crop, and utilizes less water. The dry DSR technique has made rice cultivation possible in areas with limited availability of water and labour. However, the major problems associated with direct seeding rice are intense weed competition in the early phases. Varieties with higher vigour under dry direct seeded conditions must be selected to enhance the competitiveness and initial crop establishment in DSR.

MATERIAL AND METHODS

The investigation was carried out during *Kharif*, 2021 at wet land farm, Sri Venkateswara Agricultural College, Acharya N. G. Ranga Agricultural University, Tirupati, Andhra Pradesh, India. The experimental material consists of 40 rice genotypes including advanced breeding lines, released varieties and land races grown in a Randomized Block Design with three replications under dry Direct Seeded Rice (DSR) conditions. Observations were recorded for yield and its attributes *viz.,* days to 50% flowering, days to maturity, panicle length (cm), plant height (cm), no. of panicles plant^{-1}, no. of filled grains panicle^{-1}, no. of chaffy grains panicle^{-1}, spikelet fertility (%), 1000 grain weight (g), grain length (mm), grain breadth (mm), grain L/B ratio and grain yield plant^{-1}. Early seedling vigour related traits such as germination percentage, shoot length (cm), root length (cm), seedling height (cm), seedling vigour index – I and seedling vigour index – II were recorded on the 14th day of germination test under laboratory conditions. Genotypic and phenotypic coefficients of variations were carried out as per the formula suggested by Burton (1952), while heritability and genetic advance were estimated according to Allard (1960) and Johnson *et al*. (1955) respectively.

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Table 1. Genetic parameters for yield, yield attributes and early seedling vigour related traits in 40 rice genotypes

S. No.	Character	Mean	Range		Variance		Coefficient of Variation		Heritability (Broad sense)	Genetic advance (GA)	Genetic advance as per cent of mean (%)
			Min.	Max.	Genotypic	Phenotypic	Genotypic	Phenotypic			
1	Days to 50% flowering	95.81	63.67	112.00	171.93	195.98	13.69	14.61	87.73	25.30	26.41
2	Days to maturity	121.33	89.67	138.00	144.45	181.76	9.91	11.11	79.47	22.07	18.19
3	Plant height (cm)	78.83	62.07	120.67	206.44	252.97	13.23	20.18	81.61	26.74	33.92
4	Panicle length (cm)	20.99	16.93	26.60	5.14	9.23	10.31	14.47	55.74	3.49	16.62
5	No. of panicles plant^{-1}	9.42	6.00	13.67	2.03	3.45	15.11	19.72	58.70	2.25	23.35
6	No. of filled grains panicle^{-1}	127.44	30.33	227.33	966.62	1158.93	24.40	26.71	83.40	58.49	45.90
7	No. of chaffy grains panicle^{-1}	17.48	7.00	30.33	42.23	45.36	37.19	38.54	93.10	12.92	73.92
8	Spikelet fertility (%)	88.25	77.78	93.38	6.15	12.68	2.81	4.04	48.50	3.56	4.03
9	1000 grain weight (g)	21.33	10.82	36.43	50.60	54.62	33.35	34.65	92.63	14.10	66.13
10	Grain length (mm)	7.74	6.41	8.51	0.29	0.35	6.89	7.60	82.34	1.00	12.89
11	Grain breadth (mm)	2.60	1.94	3.10	0.09	0.10	11.71	12.44	88.55	0.59	22.69
12	Grain L/B Ratio	3.02	2.28	4.03	0.14	0.15	12.44	13.00	91.53	0.74	24.53
13	Grain yield plant^{-1}	21.54	11.08	39.76	31.93	37 34	26.25	28.36	85.66	10.78	50.05
14	Germination (%)	87.41	66.67	100.00	95.06	107.60	11.15	11.37	88.35	13.38	21.60
15	Shoot length (cm)	9.21	6.82	13.53	1.20	2.03	11.91	15.47	59.31	1.74	18.90
16	Root length (cm)	9 53	5.67	13.13	1.36	2.87	14.33	17.79	64.90	2.27	23.73
17	Seedling height (cm)	18.65	14.21	26.65	4.93	5.60	11.91	12.69	88.09	4.30	23.03
18	Seedling vigour index-I	1623.17	1201.33	2532.33	75284.39	82089.48	16.90	17.65	91.71	541.29	33.35
19	Seedling vigour index-II	12.81	5.56	20.67	9.12	9.56	23.57	24.12	95.47	6.03	47.44

RESULTS AND DISCUSSION

The analysis of variance revealed significant differences for all the characters studied indicating the presence of considerable amount of variability among the genotypes. The grand mean, range, variance, phenotypic and genotypic coefficients of variation, heritability and genetic advance as percentage of mean are presented in Table 1.

The phenotypic coefficient of variation was slightly higher than the corresponding genotypic coefficient of variation indicating that the existing variation is not only due to differences among the genotypes but also due to environment. Highest estimates of GCV was recorded for number of chaffy grains panicle^{-1} (37.19%), followed by 1000-grain weight (33.35 %), grain yield plant^{-1} (26.25%), number of filled grains panicle^{-1} (24.40 %), seedling vigour index – II (23.57%). This indicated the presence of extensive inherent variability among the genotypes, which is more useful for exploitation in selection. Similar higher estimates of variability were reported earlier by Dhanwani *et al*. (2013) for number of chaffy grains panicle^{-1}; Ekka *et al.* (2015), Ashok *et al.* (2016), Devi *et al.* (2020), Mishra *et al.* (2021) and Shrestha *et al.* (2021) for Grain yield plant^{-1} and Devi *et al.* (2020) for number of filled grains panicle^{-1} and 1000-grain weight

High heritability was recorded for the characters *viz.,* seedling vigour index – II (95.47 %), number of chaffy grains panicle^{-1} (93.10%), 1000-grain weight (92.63 %), seedling vigour index- I (91.71%), grain L/B ratio (91.58%), grain breadth (88.55 %), germination percentage (88.35%), seedling height (88.09 %), days to 50% flowering (87.73 %), grain yield plant^{-1} (85.66%), number of filled grains panicle^{-1} (83.40 %), grain length (82.34 %), plant height (81.61%), days to maturity (79.47%) and root length (64.90%), while moderate heritability was observed for shoot length (59.31%), number of panicles plant^{-1} (58.70 %), panicle length (55.74 %) and spikelet fertility (48.50%) indicating that these characters can be selected and improved through simple phenotypic selection. Similar kind of high estimates of heritability were also reported by Akshitha *et al*. (2020) for germination percentage , root length , seedling height, seedling vigour index –I and II , Abawa (2022) for number of chaffy grains panicle^{-1}; Metwally *et al.* (2022) for 1000-grain weight and plant height; Thakur and Pandey (2020) for grain L/B ratio, grain breadth and grain length; Thakur and Pandey (2020) for days to 50% flowering and grain yield plant^{-1}; El-Hadi *et al.* (2017) for number of filled grains panicle^{-1}; Mishra *et al.* (2021) for days to maturity.

High heritability coupled with high genetic advance as per cent of mean was recorded for seedling vigour index – II (95.47%; 47.44%), number of chaffy grains panicle^{-1} (93.10%;73.92%), 1000-grain weight (92.63%; 66.13%), seedling vigour index- I (91.71%; 33.35%), grain L/B ratio (91.58%; 24.53%), grain breadth (88.55%; 22.69%), germination percentage (88.35%; 21.60%), seedling height (88.09%; 23.03%), days to 50% flowering (h^2_{bs} = 87.73%; GAM = 26.41%), grain yield plant^{-1} (85.66%; 50.05%), number of filled grains panicle^{-1} (83.40%; 45.90%), plant height (81.61%; 33.92%) and root length (64.90%; 23.78%) suggesting better scope of their improvement through selection, as these characters were predominantly governed by additive gene effects.

Similar results of high heritability coupled with high genetic advance as per cent of mean have been reported by Mishra *et al*. (2019) for seedling vigour index – II, seedling vigour index- I and root length; Abawa (2022) for number of chaffy grains panicle^{-1}**;** Abawa (2022) for plant height**;** Gokulakrishnan *et al.* (2014) for grain breadth; Gokulakrishnan *et al.* (2014) and Thakur and Pandey (2020) for grain L/B ratio; Kumar *et al.* (2018) for 1000-grain weight; Radha *et al.* (2019), Thakur and Pandey (2020) and Abawa (2022) for grain yield plant^{-1}; Ekka *et al.* (2015) and Devi *et al.* (2017) for number of filled grains panicle^{-1}.

Based on the above results, it could be concluded that the characters, number of chaffy grains panicle^{-1}, 1000-grain weight, grain yield plant^{-1}, number of filled grains panicle^{-1} and seedling vigour index – II recorded high PCV, GCV, heritability (broad sense) and genetic advance as per cent of mean indicating that these characters were governed by additive gene action and simple selection would be more rewarding for their improvement.

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