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RESEARCH PAPER

Evaluation of different rice (*Oryza sativa* L.) varieties for upland situations of Kerala

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Abstract : The development of a high yielding variety is the major objective of any breeding programme. So the genetic parameters for yield and its component characters in upland rice were estimated in the present investigation with seven rice varieties during *Kharif* 2009 at Onattukara Regional Agricultural Research Station, Kerala Agricultural University, Kayamkulam. Seven characters related to yield were evaluated and variability parameters were estimated. In the study maximum grain yield was recorded by the variety Bhagya followed by Jyothi. Genetic analysis was also conducted and the result indicated that the phenotypic coefficient of variation was higher than the genotypic co-efficient of variation for plant height, number of tillers, number of productive tillers, number of grains per panicle, grain weight and straw weight. But low heritability was recorded for all the characters except panicle length.

Key Words : Rice, Genetic advance, Heritability, Yield

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INTRODUCTION

Rice (*Oryza sativa* L.) is the staple food of more than three billion people in the world, most of whom live in Asia. Rice contributes around 45 per cent of India's cereal production and is the main staple food for over 60 per cent of the population in the country. In many countries, rice accounts for more than 70 per cent of human caloric intake. It is cultivated under diverse moisture regimes which includes irrigated and rainfed upland and lowland, deep water etc. Irrigated rice accounts for 55 per cent of world area and about 75 per cent of total rice production. Rainfed lowland represents about 25 per cent of total rice area, accounting for 17 per cent of world rice production. Upland rice covers 13 per cent of the world rice area and accounts for 4 per cent of global rice production. Deep water rice, although it has less area, meets the need of around 100 million people. In India, the total area under irrigated, rainfed lowland and upland rice is 22.0, 14.4, and 6.3 million ha, respectively (Singh, 2009). Upland rice is generally more prone to drought than lowland rice because there is no field accumulation of water in this system due to the lack of a bund or hard-pan layer and often, due to unlevel, sloping topography.

In Kerala rainfed upland rice cultivation is gaining importance and the crop is grown in unbunded fields having good soil drainage and devoid of standing water . It is direct-seeded into the dry soil. Traditional upland rice varieties are low-yielding and prone to lodging, but are adapted to non-flooded soils. The suitability of the existing varieties has to be tested before making a general recommendation to the farmers and to utilize the lines in further breeding programmes.

MATERIAL AND METHODS

The materials comprised of seven short duration varieties of rice. These were raised in three replications at the Farm of Onattukara Regional Agricultural Research Station during 2009 *Kharif* in plot size 5x2m at a spacing of

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15x10 cm. Recommended agronomic practices were followed to raise a good crop. Observations were recorded on plant height, total number of tillers, total number of productive tillers, length of panicle, number of grains per panicle, grain weight and straw weight. The data were subjected to statistical analysis to find out genotypic and phenotypic variance as suggested by Lush(1940), genotypic and phenotypic coefficient of variation by Burton (1952), heritability (Lush,1940) and genetic advance as suggested by Johnson *et al.*(1955).

RESULTS AND DISCUSSION

Most important aim of any plant breeding programme is to develop varieties with high yield potential by utilising the genetic variability (Jing and Jianchang, 2011). The genetic variation for the traits under selection process and heritability and genetic advance are important selection parameters to identify the best cultivars in breeding programme (Falconer and Maccay, 1996; Ulloa, 2006). Selection for yield potential is an important element in developing varieties that produce acceptable yields under moderate levels of stress.

In the present study, the phenotypic coefficient of variation ranged from 7.41 to 42.46 per cent while the genotypic coefficient of variation (GCV) ranged between 4.65 and 21.15 per cent (Table 1). However, the phenotypic coefficient of variability was higher than the genotypic one in all the studied characters, but relatively equal portion of PCV was contributed by the environmental component and genotypic component. Phenotypic coefficient variation (PCV) was found to be higher than genotypic coefficient of variation (GCV) for all the characters indicating the role of environmental variance in the total variances. Similar trend was reported by Karad and Pol (2008).The difference between PCV and GCV was high for characters *viz.*, plant height, total number of tillers, number of panicles, grains per panicle , grain weight and straw weight and low for panicle length . High difference indicates that these characters were affected by environment (Table 1). High GCV was recorded for number of tillers per plant which indicates that this character can be improved through selection. Moderate GCV values were recorded by number of panicles per plant, number of grains per panicle and straw yield where as plant height , panicle length, and grain yield recorded low GCV values.

Heritability and genetic advance for each trait are presented in Table 1. Heritability percentage is estimated as a ratio between the genotypic variance and the total phenotypic variance. Estimates of heritability in broad sense were ranging from 16.10 to 90.90 per cent (Table 1). High heritability estimates were recorded for panicle length and moderate heritability was recorded for grains per panicle and straw yield. Characters like plant height, number of tillers per plant, number of panicles per plant and grain yield recorded low heritability. Heritability estimates are useful in selection programmes based on phenotype.

High genetic advance was recorded for number of tillers per plant and moderate genetic advance was recorded for number of panicles per plant, panicle length , grains per panicle and straw yield. Plant height recorded low genetic

Table 1 : Estimates of genetic parameters in rice under upland conditions

Characters	Mean	PV	GV	PCV	GCV	Heritability	GA %
Plant height cm	103.78	144.93	23.33	11.60	4.65	16.10	3.84
No.of tillers	7.58	10.36	2.57	42.46	21.15	24.87	21.64
No.of panicles	9.63	7.95	2.37	29.28	15.99	29.81	17.98
Panicle length cm	19.93	2.09	1.9	7.41	7.06	90.90	13.83
Grains/ panicle	65.5	223.90	69.69	22.84	12.75	31.12	14.65
Grain yield/ha	2.86	0.24	0.06	17.13	8.74	25.0	8.81
Straw yield/ha	8.46	3.92	1.52	23.40	14.57	38.77	18.68

Table 2 : Performance of rice genotypes in the upland field

Sr. No.	Variety	Plant height cm.	No. of tillers/hill	No. of panicles/hill	Panicle length cm	Grains / panicle	Grain yield kg ha^{-1}	Straw yield kg ha^{-1}
1.	Hriswa	90.4	8.6	7.6	21.1	65.33	3.51	5.36
2.	Onam	100.8	13.8	12.4	19.51	55.74	3.01	6.6
3.	Jyothi	105.4	10	9.6	20.18	83.63	3.61	6.11
4.	Bhagya	86.46	8.3	7.3	21.46	68.8	3.96	6.98
5.	Chingam	140.2	9.33	8.6	19.6	69.7	3.11	6.61
6.	Red Triveni	85	13.6	12.3	20.5	67.7	3.51	5.78
7.	Vandana	118.2	10.33	9.6	17.22	47.6	2.37	7.00
	CD	19.58			1.94			
	CV	9.06	36.8	24.52	5.59	18.96	14.83	18.31

advance. High heritability coupled with moderate genetic advance (Table 1) was observed for panicle length. This indicates that selection process for this trait would certainly bring improvement in the genotypes. Burton (1952) reported that genotypic coefficient of variability, together with heritability estimates would give a clear picture about the extent of advance to be expected from selection, therefore, the expected gain from selection (g%) would be a better indicator for selection response. In conclusion, genetic improvement would be feasible by selection among the tested genetic background for further enhancement of parameters with moderate to high genetic advance which results in a higher yield potential.

In the upland ecosystem, drought and the incidence of pests and diseases are the major limiting factors in rice productions. Perusal of Table 2 shows that the varieties recorded significant variation in plant height and panicle length. Maximum height was recorded by Chingam followed by Vandana. But these varieties showed lodging at maturity stage. Maximum panicle length was recorded by Bhagya followed by Jyothi. Maximum grain yield was recorded by Bhagya followed by Jyothi and straw yield was maximum for Vandana followed by Bhagya. Recent studies at IRRI have shown moderate to high heritability of grain yield under drought (Bernier *et al*., 2007; Venuprasad *et al*., 2007; Kumar *et al*., 2008), thus opening area for direct selection for grain yield instead of secondary traits. Further, direct selection for grain yield under drought has been reported effective (Kumar *et al*., 2008; Venuprasad *et al*., 2008) and the feasibility of combining high yield potential with good yield under drought has been demonstrated beyond a doubt (Kumar *et al*., 2008; Venuprasad *et al*., 2008). By employing direct selection for grain yield under drought, several promising breeding lines for rainfed lowlands and rainfed uplands have been identified recently (Verulkar *et al*., 2010; Mandal *et al*., 2010). In the present study also Bhagya was identified as a promising variety for upland cultivation in Kerala during *Kharif* season.

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