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VARIABILITY STUDIES IN NAGALAND SPECIAL RICE (*ORYZA SATIVA* L.) CULTIVARS

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Abstract

Rice is the staple food crop of more than 60% of world's population. In terms of area and production, it is second to wheat.. It is the foremost cereal crop of the world providing 22% of the world's calories and 17% of proteins. Globally, the cultivation of rice extends from 39ºS latitude to 45ºN latitude. Rice is grown worldwide in varying conditions of soil and climate. Rice is also the major crop of north-eastern parts of our country occupying 3.5 million hectare area. The north-eastern region accounts for 11% of national rice area and 6.5% of total national production. Nagaland is the hill state of north-east India. It is situated between 93º-95ºE longitude and 25º-27ºN latitude. The hills of the state of Nagaland are situated in the range from 194 to 3840 m above mean sea level and characterized by considerable topographical variation. Rice is the major crop of the state and is mainly grown in lowland and upland conditions. The total area under rice is 146 thousand hectare with the production of 206 thousand tonnes. The tribal farmers of hilly region of Nagaland grow different cultivars of Nagaland special rice, which are generally suited to lowland conditions. Twenty two cultivars of Nagaland special rice have been evaluated for extent of genetic variability and character association among various quantitative traits at School of Agricultural Sciences, Medziphema (Nagaland), India. Analysis of variance revealed significant variation in respect of characters such as days to 50% flowering, days to maturity, no. of tillers, panicle weight and yield. Maximum genetic coefficient of variation was observed for yield and 100 seed weight. Significant positive correlation of effective tillers and 100 seed weight with yield was observed. Out of the 22 cultivars the cultivar "Kemelio" and "Kolchang" have been found promising.

Key words : Rice (*Oryza sativa* L.), plant height, grain length, yield per plant, genotypes, cereal crop.

Introduction

Rice (*Oryza sativa*) belongs to family Graminae is the staple food crop of more than 60% of world's population. The total production of rice in the world amounts to 672,015,587 metric tonnes (Anonymous, 2010). Although in terms of area and production, it is second to wheat, yet it is the most important cereal crop consumed globally. Rice provides 21% of global human per capita energy and 15% of per capita protein. Although, rice protein ranks high in nutritional quality among cereals, protein content is modest. Rice also provides minerals, vitamins and fiber, although all constituents except carbohydrates are reduced by milling (Anonymous, 2005). Among the rice growing countries, China has the largest area accounting for about 28% of the total area under rice. India ranks second with 120,620,000 metric tonnes in rice production next to China. As per the report of Directorate of Rice Development, Patna 2012; the total area under rice in India during 2010-11 is 428.625 lakh hectares with the total national production of 959.797 lakh tonnes (Anonymous, 2012).

Rice is the major crop of north-eastern region occupying 3.5 million hectares that accounts for 10.48% of total rice area and 6.46% of total rice production in the country. Rice grown in the region can be primarily classified into six classes. These are 'Ahu' or 'Autumn rice', 'Sali' or Kharif rice also called winter rice, 'Bao' or deep water/floating rice. It can be further subdivided into upland and lowland rice.

Rice is the most important food grain crop of the State of Nagaland and grown throughout the state under upland conditions, direct seeded on hill slopes and irrigated lowland conditions. The total area under Rice cultivation in Nagaland is 1,81,400 hectares with the production of 318 thousand tonnes (Anonymous, 2012). The hill state

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of Nagaland is situated between 93° – 95° E longitude and 25°- 27° N latitude. It ranges from 194-3840 m above mean sea level and is characterized by considerable topographical variation.

Cultivars of Nagaland special which are suited to low land conditions of Nagaland have quantitative and qualitative traits desirable for agro-ecological conditions of the state of Nagaland. Within the state Nagaland special is best adopted and gives maximum returns at Medziphema and adjacent areas having altitude of 100-1400 ft above msl (Ngachan, 1993). The present study was conducted to study the enormous variability present in these cultivars and identify the best one for utilizing in breeding programme.

Materials and Methods

The experiment was conducted at the experimental field of Department of Genetics & Plant Breeding, School of Agricultural Sciences, Nagaland University Campus Medziphema (Nagaland), India; which lies between 25^0 45' 43" N and 93^0 53' 4" E longitude at an elevation of 310 m above mean sea level. The average rainfall varies between 2000 mm to 2500 mm and temperature ranges between 11^{0}C to 33^{0}C with the subtropical climate coupled with high relative humidity.

A total of 21 cultivars of rice popularly known as Nagaland Special Rice have been procured from different places of Nagaland. All of them have specific common names in the areas of their cultivation. The cultivars procured from Khaibung area have been named as V1 to V8 and are traditionally names as Alem special, Kolchang, Changbem, Changvom, Singson Chang and Changsen; similarly ten cultivars locally known as Kohima special, Kemelio, Jalukie KI, Khurson, Chakhesang lha, Kemelo-u, Kemese-u, Kemesou, Kekhrielha and Changpem were collected from Sochunuma area. The cultivars *viz*. Kemese, Sirhilha and Kemelo were procured from Medziphema area and one Ranjit from Jharnapani area of the State of Nagaland.

Initially all the cultivars along with variety Ranjit were grown in nursery then seedlings of 25 days of age have been transplanted to the main field. All the cultivars have been grown in Randomized Block Design under lowland conditions of experimental farm of the department of GPB with three replications. In the main field the individual plot size was 1.0m × 1.5m and spacing of 20 × 15 cm was maintained. Time to time observations on various characters such as days to 50% flowering, plant height, effective tillers, leaves per tiller, days to 80% maturity, panicle weight, branches per panicle, panicle length, 100

Table 1 : Analysis of Variance for different quantitative characters in rice.

Source of variation	D.F.	Mean Sum of Squares (MSS)									
		Days to 50% flowering	Plant height (cm)	Effective tillers	Leaves per tiller	Days to maturity	Panicle length (cm)	Panicle weight (g)	Branches per panicle	100 seed weight (g)	Grain L/B ratio	Yield per plant (g)
Replications	2	0.05	301.51	13.46	2.92	0.01	6.91	13.87	1.68	0.01	0.02	79.14
Cultivars	21	126.5**	603.11	4.21*	0.75	232.00**	5.75	19.33**	2.98*	0.56**	0.28**	3370.68**
Error	42	0.05	504.61	2.15	0.81	0.03	3.17	9.14	1.31	0.02	0.04	65.26

* Significant at 5% level, ** Significant at 1% level.

Table 2 : Estimates of mean, range, coefficient of variation, heritability and genetic advance as % of mean.

Characters	Mean	Range	Coefficient of variation		Heritability	Genetic advance as % of mean
			Phenotypic coefficient of variation (PCV)	Genotypic coefficient of variation (GCV)		
Days to 50% flowering	95.89	85-105	6.77	6.76	0.99	13.93
Plant height	151.48	124.33-178.53	15.22	3.76	0.06	1.91
Effective tillers	8.39	5.66-10.33	20.07	9.86	0.24	9.99
Leaves per tiller	6.39	5.33-7.00	13.92	2.26	0.02	0.75
Days to maturity	122.75	103-135.33	7.16	7.16	0.99	14.75
Panicle length	27.14	24.46-29.70	7.40	3.41	0.21	3.25
Panicle weight	21.08	11.98-22.65	21.43	11.14	0.27	11.94
Branches per panicle	11.90	9.00-13.33	11.49	6.27	0.29	7.04
100 seed weight	2.82	1.93-3.72	15.84	14.99	0.89	29.22
Grain L/B ratio	2.91	2.33-3.51	12.18	9.79	0.64	16.24
Yield per plant	172.89	120.72-229.02	19.76	19.19	0.94	38.42

seed weight, grain length/breadth ratio and yield per plant have been recorded. The analysis of variance was done in RBD as per Panse and Sukhatme (1957).

Results and Discussion

On analysis of data from all the 21 cultivars and Ranjit for various traits, significant variability was observed for all the traits except plant height, leaves per tiller and panicle length.

Mean performance of genotypes

The general mean for days to 50% flowering was 95.95 and ranged between 85-111 days while that for plant height was 152.31 and range was 174.53 cm to 124.33 cm. The minimum effective tillers were observed in V-1 (5.66) and maximum *i.e.* 10.00 in V-15 with the general mean of 8.39. The general mean for leaves per tiller was 6.39 with the range of 5.33 to 7.00. The V-11 matured early *i.e.* in 103 days while V-10 took 135.33 days to mature. The panicle length was ranged between 24.46 cm to 29.70 cm with the general mean of 27.15 cm. The maximum weight for panicle was 22.65 g and minimum was 11.98 g with the general mean of 16.53 g. The number of branches per panicle ranged from 9.00 to 13.33 with the general mean of 11.99. The maximum test weight *i.e.* 100 seed weight of 3.72 g was exhibited by V-14 and the minimum of 1.93 g by V-22 with the general mean of 2.83 g. The grain L/B ratio ranged between 2.33 to 3.51 with the general mean of 2.91. The maximum yield of 229.02 g was produced by V-6 and that of minimum (120.73 g) by V-19 with the general mean of 172.89 g.

Coefficient of variation

The highest coefficient of variation (PCV) was observed for panicle weight (21.43) followed by effective tillers (20.07) and yield per plant (19.76). The lowest value for PCV was seen in days to 50% flowering (6.77). The maximum GCV was estimated for yield per plant (19.0) followed by 100 seed weight (14.99) while the number of leaves per tiller exhibited the lowest value of GCV *i.e.* 2.26.

The success of any breeding programme depends largely on the presence of significant genetic variability to permit effective selection. In any crop improvement programme adequate variability and other associated features like heritability and genetic gain under selection must be known in order to formulate an efficient and rational breeding programme. It is imperative to assess the relative magnitude of components of variability, heritability and genetic advance to improve grain yield.

The eleven characters under study were subjected to analysis of variance, which revealed significant variation among genotypes in respect of all the characters except plant height, leaves per tiller and panicle length. These results are in accordance with Awasthi and Pandey (2000), Bala (2001), Kavita and Rama Reddi (2002). It was observed that the values of GCV were lesser than PVC, which indicated that environment had more influence in the characters under investigation. High values of PCV and GCV were found for the characters *viz*. effective tillers, panicle weight, 100 seed weight, grain L/B ratio and yield. Chauhan *et al*. (1989) also reported that branches per panicle exhibited the highest level of variation. Mishra *et al*. (1996) also observed high values

of PCV for 100 grain weight and yield. The maximum GCV and PCV were recorded for grain yield per plant; Satish *et al*. (2004) also reported similar findings.

Although PCV was found to be more than GCV, it was observed that the difference between the two was minimum in characters like days to 50% flowering, maturity and yield per plant. Wide variations between GCV and PCV values were observed in the traits such as plant height, effective tillers, leaves per tiller, panicle weight, panicle length and branches per panicle. Chauhan *et al*. (1989) noted a vast difference between PCV and GCV values for panicle weight. The minimum difference between PCV and GCV indicates high genetic influence whereas the maximum difference is an indication of the major role played by environment.

From the present investigation it may be concluded that traits such as days to 50% flowering, days to maturity, 100 seed weight and yield per plant may be some very important traits for further studies in Nagaland special rice cultivars. The cultivar Kemelio needs to critically analyzed as it seems to have a broad genetic base and can thrive and perform well.

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