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Performance of Coarse Rice Genotypes in the Plains of D.I. Khan, Pakistan

Rafiqullah Shah, M. Zubair Sulemani, M. Safdar Baloch and Gul Hassan

Agricultural Research Institute and Department of Agronomy, Gomal University, D.I. Khan, Pakistan

Abstract

Eight rice genotypes viz. KS-282, IR-6, DR-83, NR-1, NIAB-6, DR-82, Lateefy and JP-5 were tested under the environmental conditions of D.I.Khan at 171.6 meters above sea level. The mean minimum and maximum temperature during the experimental season ranged between 14 and 42°C. The effect of high temperature on the genotypes was observed as reduction in yield and yield components like plant height, number of tillers per hill (Tillering ability), days to 50 percent flowering, seedling vigour, 1000-grain weight and grain yield. A considerable amount of genetic variability was observed at each growth stage in the season. The environmental effect on commercial variety IR-6 and the newly evolved variety KS-282 in tillering ability and 1000-grain weight indicated non-significant and significant differences, respectively. It is therefore, concluded that while selecting for high temperature tolerance the material should be tested in the actual hot areas and screening should be made in the target environments.

Introduction

Rice (*Oryza sativa* L.) is one of our important food crops of Pakistan. Beside its importance as a food crop, about 23 percent of the total foreign exchange earnings is shared by rice (Khokhar and Soomro, 1976) and thus called as "Golden grain of Pakistan" (Ahmad, 1976). Rice is also important for soil reclamation (Shah *et al.*, 1980). Its cultivation can play a significant role in areas of warmer climatic conditions like D.I.Khan, because it grows well in warm temperature and sufficient moisture (Suhag and Bhutto, 1976). In D.I.Khan the acreage is expanding rapidly due to the Chashma Right Bank Canal (CRBC) irrigation project which will eventually occupy 20 to 25 percent of the command area of 0.14 million hectares.

Exotic as well as local rice germplasm is collected for isolation of desirable genotypes adoptable to agro-climatic conditions and suitable to local aggro-based industry. This enables the rice discipline to evolve high yielding, better quality cultivars to increase the present yield level from 2 to 3.4 t ha⁻¹. Since, rice is grown under varying climatic conditions, therefore, rice varieties adoptable to specific agro climatic conditions are to be developed. The present study was, therefore, undertaken to evaluate different rice genotypes and to select cultivars with high yield potentials which can resist high air and water temperature in D.I. Khan.

Materials and Methods

The research project was conducted at the Agricultural Research Institute, D.I. Khan. Out of the eight rice genotypes studied KS-282 was developed and released from Kale Shah Kaku, Rice Research Institute and is under general cultivation in D.I. Khan. IR-6, an IRRI variety is also under cultivation in D.I. Khan. DR-82, DR 83 and Lateefy are from Sindh. JP-5 is from Swat. NR-1 and NIAB-6 are from NIAB, Faisalabad. The land was ploughed thoroughly and planking was done, Farm yard manure was applied at 1 t h⁻¹ to the field and mixed with the soil. Recommended

doses of Nitrogenous, phosphatic and potash fertilizers (120-90-60 kg/ha) were applied. All other agronomic practices were provided at par to all the treatments. Thirty five days old nursery of eight varieties was transplanted in the plots. The experiment was laid out in a Randomized Complete Block Design having three replications with a net plot size of 2x0.90 m². Three rows of each variety per replication were planted and the central row was used for recording data. The net harvested plot size was 2.0x0.30 m², The data were subsequently converted to the yield per hectare in tonnes. The data were also recorded on morphological and agronomic traits like plant height (cm), tillers per hill, days to 50 percent flowering and 1000-grain weight (g).

The data on each character were analyzed statistically by analysis of variance technique and means were separated by using Duncan's New Multiple Range Test (Gomez and Gomez, 1981).

Results and Discussion

Plant height at maturity (cm): A perusal of Table 1 exhibits that the variety NR-1 was the tallest with plant height of 146.7 cm. Varieties NIAB-6, DR-82, Lateefy, KS-282 and IR-6 were intermediate in stature and had the plant height of 106.5, 102.2, 104.4, 104.4 and 91.7 cm. respectively. While the dwarfest varieties DR-83 and JP-5 possessed the plant height of 82.8 and 77.2 cm respectively. Chang and Oka (1976) stated that climatic factors affecting the general and specific adoption of rice cultivars are day length, temperature, precipitation, and wind. Tanaka (1976) reported that plant growth has two aspects: dry matter production (qualitative change) and phase development (quantitative change) and third phenomenon results from the environment-variety-cultural practices interaction. The interaction of each cultivar with environment showed significant differences for vigour of seedling (Satake and Yoshida, 1978, Swamy, 1970: Saini and Gagneja, 1975).

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Tillers per hill (No.): Varieties DR-82 and NIAB-6 were found to have higher tillering abilities of 26.1 and 25.80 tillers per hill (Table 1). Varieties DR-83 and Lateefy were found next higher in tillering capacity of 21.9 and 21.80 tillers per hill, respectively. Varieties KS-282, NR-1 and IR-6 were found lower in tillering ability 17.3, 17.10 and 16.20 tillers per hill respectively. Variety JP-5 was found lowest in tillering ability and it had 15.20 tillers per hill. Chang and Vergara (1971) reported that rice varieties differ in their response to low and high temperature at various growth stages. Lee (1979) showed that low temperatures decreased the tillering ability.

Day to 50 percent flowering: The data presented in Table 2 indicated that the varieties NR 1, NIAB-6 and JP-5 took 72.33, 71.67 and 71.00 days to 50 percent flowering against IR-6 and KS-282 local checks with 62 and 57 days to 50% flowering, respectively. These varieties were followed by DR 82, IR-6, DR-83 and Lateefy and KS-282 with 63.67, 62.00, 61.00, 60.00 and 57 days to 50% flowering, respectively. The opening of the spikelets depend primarily on the prevailing atmospheric temperature, the light intensity and other climatic conditions (Vergar and Visperas, 1971).

Seedling vigour (cm): The data shown in Table 2 revealed that the varieties JP-5, Lateefy and DR-82 manifested higher seedling vigour by attaining height of 31.71, 30.83 and 30.00 cm, respectively. These varieties were followed by KS 282 and NIAB-6 with 29.17 and 28.33 cm height, respectively. Varieties IR-6, NR-1 and DR-83 expressed lower seedling vigour and were at par. The seedling vigour of IR-6, NR-1 and DR-83 was 27.50, 26.00 and 25.83 cm, respectively.

Table 1: Plant height (cm) and number of tillers per hill as affected by different rice genotypes

Varieties	Plant height (cm)	Tillers/hill (No.)
KS-282	104.4 b	26.10 ^{NS}
IR-6	91.7 bc	25.80
DR-82	102.2 b	21.90
NR 1	146.1 a	21.80
NIAB-6	106.5 b	17.30
DR-83	82.8 c	17.10
Lateefy	104.4 b	16.20
JP-5	77.2 c	15.20

NS: Non-significant

1000-grain weight (g): It is obvious from the data given in Table 3 that the varieties JP-5 and NR-1 gave the highest 1000-grain weight of 27.9 and 27.5 g, respectively. Variety IR-6 gave higher 1000-grain weight of 23.5 g. However, this variety was found at par with KS-282 with 1000-grain weight of 23.3 g, respectively. Varieties DR-82 and NIAB-6 gave next higher 1000-grain weight of 22.9 and 22.5 g,

respectively whereas the lowest 1000-grain weight of 21.5 and 21.0 g, was produced by varieties Lateefy and DR-83, respectively.

Table 2: Days to 50 percent flowering and seedling vigour as affected by different rice genotypes

Varieties	Days to 50% flowering	Plant height (cm)
KS-282	57.00 c	29.17 ac
IR-6	62.00 bc	27.50 cd
DR-82	63.67 d	30.00 ac
NR-1	72.33 a	26.00 d
NIAB-6	71.67 a	28.33 ac
DR-83	61.00 bc	25.83 d
Lateefy	60.00 bc	30.83 ab
JP-5	71.00 a	31.67 a

Table 3: 1000-grain weight (g) and grain yield (t/ha) as affected by different rice genotypes

Varieties	1000-grain weight (g)	Grain yield (t/ha)
KS-282	23.3 ab	8.3 a
IR-6	23.5 ab	5.8 ab
DR-82	22.9 b	6.6 ab
NR-1	27.5 a	5.8 ab
NIAB-6	22.5 b	6.6 ab
DR-83	21.0 h	2.5 b
Lateefy	21.5 h	2.5 b
JP-5	27.9 a	4.2 ab

Means sharing a letter in common do not differ significantly by Duncan's multiple range test (DMRT) at 0.05 probability level

Grain Yield (t/ha): The variety KS-282 gave the highest grain yield of 8.3 t/ha (Table 3). It was followed by varieties DR-82, NIAB-6, IR-6, NR-1 and JP 5 giving grain yield of 6.6, 6.6, 5.8, 5.8 and 4.2 t/ha, respectively. Whereas varieties Lateefy and DR-83 each gave the lowest grain yields of 2.5 t/ha. Majid and Rehman (1986) tested KS-282 and IR-6 for several years and reported that KS-282 is higher yielding than IR-6.

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