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Performance of Candidate Varieties of Basmati Rice in National Uniform Yield Trials

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Abstract:

Ten candidate varieties of basmati rice along with two check varieties Basmati 515 and Super Basmati were evaluated at seven locations throughout Pakistan in National Uniform Yield Trials (NUYT) during 2013. Current study was carried out to find the genetic variability among these varieties for paddy yield and to identify better high yielding varieties to release for general cultivation. Significant differences for paddy yield were observed among entries in pooled analysis. Maximum mean paddy yield (4683.2 Kg/ha) of seven locations was observed in entry BR-1, followed by entry PK 8431-2-1-2-4 (4554 Kg/ha). On the basis of mean paddy yield, the entries viz; BR-1, PK 8431-2-1-2-4, BR-18, R-456, BR-23, PK 8647-11-1-1, PK 8892-4-2-1-1, PK 8685-5-1-1-1-1, and NIAB-1175 may be recommended for general cultivation.

Key words: Rice, *Oryza sativa*, paddy yield, national uniform yield trails, Pakistan.

Introduction

Among cereals, rice (*Oryza sativa* L.) is the leading cereal of the world [1] and more than half of the human race depends on rice for their daily nutrition [2]. It is also primary source of income and employment for more than 100 million households in Asia and Africa [3]. World's rice demand is projected to increase by 25% from 2001 to 2025 to keep pace with population growth [4] and therefore, meeting ever increasing rice demand in a sustainable way with shrinking natural resources is a great challenge in the coming days. Rice holds a prominent position in the agro-based economy of Pakistan. It is a high value cash crop, accounting for 6.4% of the value-added in agriculture and 1.4% in gross domestic product. It is the second largest agricultural export commodity of Pakistan after cotton [5].

Basmati rice considers a special group of rice which is known as the best quality rice worldwide. Aromatic rice is becoming popular in Middle East, Europe and USA. Pakistan, India and Thailand are the major producers and partners in the global trade of aromatic rice. Aromatic rice from India and Pakistan consist of Basmati types. Cultivation of which in Indian sub-continent dates back to antiquity and its cultivation is believed to have spread from the foot hills of the Himalayas, South West into the Indian sub-continent, into South East Asia and East ward into China and Japan [6].

Although world rice production has doubled in the past 30 years due to the introduction of superior varieties and better cultivation practices, but it is still unsatisfactory to meet ever increasing global demands [7, 8]. From 2001 to 2025, it is estimated that the demand for rice in the world would increase

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at about 1% per annum, so the present average yield has to be increased considerably in order to meet up the rising needs [4].

Among Asian rice growing countries, Pakistan is a major producer of many rice varieties such as aromatic rice and old landraces. Varieties of basmati rice, subspecies of indica, are cost-effectively important due to high quality of the grain and comprise an important source of revenue. Pakistan ranks 14th in terms of rice production and 6th in rice export in the world. Rice occupies 2.96 million hectares that is 12% of the total cultivated area. Its production was 6.95 million tones and 2347kg yield per hectares [9]. Grain yield, being a quantitative trait is a complex character of any crop. Various morphological and physiological plant characters contribute to yield. These yield contributing components are interrelated with each other showing a complex chain of relationship and also highly influenced by the environmental conditions [10].

The present research study was conducted to find out the genetic variability among different candidate varieties of basmati rice for paddy yield and to identify better high yielding fine rice genotypes. The ultimate goal of varietal improvement programs is the evolution of superior genotypes. The multi-environmental trials National Uniform Yield Trials (NUYT) are a vital link between genetic improvements and the production environments. Provincial institutions have rare chances to test their improved materials across the country within their own sources. Evaluation of elite lines at several levels including initial screening at the experimental stations, preliminary testing in micro plot trials and final evaluation in the National Uniform Yield Trials (NUYT) are the main steps before the release of new varieties. This study is concerned with the final testing of the evaluation phase particularly the analysis and collection of data required to justify cultivar release and recommendations for commercial production.

Materials and Methods

Ten candidate varieties of fine rice along with two check varieties were evaluated at the following seven locations throughout the country in National Uniform Yield Trails.

1. Rice Program, National Agricultural Research Center, Islamabad
2. Nuclear Institute for Agriculture And Biology (NIAB), Faisalabad, Pakistan
3. Nuclear Institute of Agriculture (NIA), Tandojam, Sindh
4. Rice Research Institute, Kala Shah Kaku, 17 Km GT Road,Lahore-39018
5. Office of the Sugarcane Specialist, Sugarcane Research Station, Sujawal
6. Rice Research Institute, Dokri, Distt. Larkana, Sindh
7. PARC Rice Unit, Agri. Adaptive Research Farm, Gujranwala

The nursery of fine rice genotypes viz., PK 8685-5-1-1-1-1, PK 8647-11-1-1, PK 8667-8-5-1-1, PK 8892-4-2-1-1, PK 8431-2-1-2-4, Basmati-515, Super Basmati, R-456, NIAB-1175, BR-1, BR-18 and BR-23 were sown during the month of June. Thirty days old nursery was transplanted in the field with a plant spacing of 20 cm x 20 cm.

The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. At maturity, data were recorded for paddy yield at all the locations. The data were subjected to analysis of variance as outlined by [11].

Result and Discussion

Entries significantly ($p<0.05$) affected the paddy yield of aromatic rice (Table 1). Maximum mean paddy yield (4683.2 Kg/ha) was observed in entry BR-1, which was followed by

entry PK 8431-2-1-2-4 (4554 Kg/ha), while minimum mean paddy yield (3640.4 Kg/ha) was noted in check variety Super Basmati. All candidate varieties produced more paddy yield than cboth check varieties Basmati-515 and Super Basmati.

Entry PK 8647-11-1-1 produced maximum paddy yield of 6280 Kg/ha at NARC location. Entry PK 8431-2-1-2-4 produced highest paddy yield (6395 kg/ha) at Dokri. The entries BR-18 (6333 Kg/ha), BR-1 (6566.7 Kg/ha), PK 8892-4-2-1-1 (5021 Kg/ha), BR-1 (5677.6 Kg/ha) and PK 8647-11-1-1 (3315.2 Kg/ha) gave maximum paddy yield at Sujawal, Tandojam, AR Farm Gujranwala, Kala Shah Kaku and NIAB, respectively.

In the light of pooled analysis for paddy yield of all the seven locations, it is suggested that the entries viz; BR-1, PK 8431-2-1-2-4, BR-18, R-456, BR-23, PK 8647-11-1-1, PK 8892-4-2-1-1, PK 8685-5-1-1-1-1, and NIAB-1175 may be recommended for general cultivation.

SOV	DF	Sum of square	Mean sum of square	F value	P value
Replication	2	208204	104102		
Location	6	8.086E+07	1.347E+07	34.18	0.000
Error replication x location	12	4731732	394311		
Entries	11	2.466E+07	2242004	13.38	0.000
Location x entries	66	1.829E+08	2771241	16.54	0.000
Error replication x location x entries	154	2.580E+07	167537		
Total	251	3.192E+08			

Table 1: Analysis of variance for grain yield of fine rice entries at 7 locations

SOV: Sources of variation; DF: Degree of freedom; CV: Coefficient of variation **Grand Mean** =4150.7; **CV (Rep*Location)** =15.13; **CV (Rep*Location*Entries)** =9.86

Locations **Entries**	**NARC**	**DOKRI**	**SUJAWAL**	**TANDOJAM**	**A.R FARM**	**KALA SHAH KAKU**	**NIAB**	**Entries means**
BR-1	3066.7 de	3500 d	6218 ab	6566.7 a	4921.3 b	5677.6 a	2832.1 cd	4683.2 A
PK 8431-2-1-2-4	6073.3 ab	6395 a	4630 cd	3080.0 fg	4529.0 c	4394.9 c	2774.6 de	4554.0 AB
BR-18	2793.3 ef	4083 cd	6633 a	5590.0 b	4221.0 d	5575.2 a	2545.9 f	4491.7 AB
R-456	5260.0 abc	6000 a	4519 d	3693.3 d	3704.1 g	4258.7 c	3139.5 ab	4373.6 BC
BR-23	1586.7 f	4000 cd	5700 b	5936.7 b	3988.0 e	4965.1 b	3139.5 ab	4188.0 CD
PK 8647-11-1-1	6280.0 a	4583 bc	3952 ef	3580.0 de	3675.0 g	3768.7 de	3315.2 a	4165.0 CD
PK 8892-4-2-1-1	4306.7 cd	4500 bc	5078 c	3290.0 ef	5021.0 a	3659.4 de	2552.8 ef	4058.3 D
PK 8685-5-1-1-1-1	5433.3 abc	4583 bc	3599 f	4180.0 c	3642.0 g	3879.7 d	3008.3 bc	4046.7 D
NIAB-1175	4700.0 bc	4333 bcd	4512 d	4066.7 c	3813.0 f	3547.0 e	3292.6 a	4037.9 DE
PK 8667-8-5-1-1	4180.0 cde	5000 b	3715 f	2770.0 g	3925.0 e	4411.6 c	2557.4 ef	3794.2 EF
BASMATI-515 CHECK	4100.0 cde	4500 bc	4363 de	2366.7 h	3533.0 h	4765.4 b	2798.3 cd	3775.2 F
SUPER BASMATI CHECK	3273.3 de	3583 d	4580 cd	3076.7 fg	4450.0 c	3690.9 de	2827.7 cd	3640.4 F
Location means	4254.4 CD	4588.5 AB	4792.1 A	4016.4 D	4118.6 CD	4382.9 BC	2902.0 E	

Table 2: Influence of entries on paddy yield (Kg/ha) of fine rice at 7 location

Means with the same case letter do not differ significantly at $p<0.05$.

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