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Original Research Article

Evaluation of for Yield, Yield Component Traits and Quality Parameters of Rice (*Oryza sativa L.*)

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A B S T R A C T

Genetic divergence was assessed among 21 rice variety including Basmati(3), Aromatic Short Grain (5), Medium Slender (3) and HYV(10).The experimental materials were evaluated during kharif- 2017 and 2018 at Crop Research Station, Masodha, Ayodhya. Physicochemical, cooking, pasting and textural properties of some rice varieties of Basmati, Aromatic short grain, Medium Slender grain and HYV were studied, of all the studied varieties was more than 3.0 and the L/B ratio of basmati varieties grains was significantly higher than non-basmati grains.Present study was carried out having high mean values for the economically important characters viz., number of total grains per panicle, number of productive tillers per plant and grain yield kg/ha etc.Hulling, mulling, head rice recovery, kernel length. Kernel bright, L/B ratio, ASV,AC, GC and aroma for the grains. Grain yield of Pusa Basmati 1 significantly higher (3672 kg/ha) followed by Pusa 1121(3488 kg/ha.), Ketki Joha (ASG)grain yield recorded was 3683 kg/ha followed by Shobini 3620,Swarna-Sub 1 (MS) grain yield was recorded in 6063 kg/ha. followed by Swarna 5750 and HYV grainyield of NDR 359(5475kg/ha.) followed by PA 6444 (5325 kg/ha.). The head rice recovery significantly higher 68.3% (MTU 1010) followed by Swarna-Sub 1 (67.20%), the mulling % higher Ketki Joha 72.20% followed by MTU 1153 71.60% . Basmati and aromatic cultivars had intermediate amylose content and MTU 1153 and Sahbhagi Dhan were grouped as low amylose containing cultivars. The GC was observed significantly lower of Gontra Bidhan 3, Swarna, Chittimuthyalu, Tarori Basmati,Pusa 1121 and Shobini (GC 22) followed by Pusa Basmati 1 and BPT 5204 (GC 24) showing the lowest hardness among all the selected rice varieties.

Keywords

Basmati rice, Aromatic short grain, Kernel length, Kernel breath, L/B ratio, Cooking characteristics

Introduction

The slogan ‘Rice is life’ aptly describes the importance of rice in food and nutritional security. Rice (*Oryza sativa L.)* is the world’s second most important cereal crop and staple food for more than 60% of the global population providing about 75% of the calorie and 55% of the protein intake in their average daily diet. Thousands of traditional variety had once existed, fewer than one hundred identified variations. The loss of these traditional varieties would not only cause insecurity in the rice growing areas of India (Vijayalakshmi *et al.*, 2007) Rice is only the cereal crop cooked and consumed mainly as whole grain, and quality considerations are much more important than for any other food crop (Hossain *et al.*, 2009). Although production, harvesting and post harvesting operations affect overall quality of milled rice, cultivars remains the most important determinant of market and end use qualities. Physiological characters of the plant are inherent characters determining the crop yield which plays an important role in variety selection (Miah *et al.*, 1996). Keeping the quality of aroma and other grain quality in aromatic fine rice is a big challenge as yield is inversely related to protein and aroma content (Terman, 1969).

Quality desired in rice vary from one geographical region to another and consumer demandcertain cultivars and favors specific quality traits of milled rice for home cooking (Juliano *et al.,* 1964). One of the major concerns in rice production has to do with seed and grain quality (Traore, 2005). While many components contribute to rice quality, the most important are cooking and eating qualities. These parameters primarily involve the physical and chemical characteristics of starch. The constituents that play important roles in cooking and eating quality are amylose content, gelatinization temperature, and gel consistency (Traore, 2005). According to (Horna *et al.,* 2005) grain quality is one of the key selection criteria highly prioritized by farmers and consumers of rice and therefore farmer select rice with traits that are desirable for consumption as well as for production and sale.

The aim of this study was to determine the physicochemical characteristics of Aromatic, HYV, and landraces/traditional rice based yield and physicochemical properties.

Materials and Methods

The present investigation was carried out during kharif, 2017 and 2018 at Crop Research Station, (ANDUAT), Masodha. Ayodhya, which is situated at 26.47^0N (latitude), 82.12 ^{0}E (longitude) and 113 m (altitude). The soil is sandy loam low in organic carbon. It is rich in potassium, medium in phosphorus and possesses good water holding capacity. The experimental material consisted of twenty one genotypes including (Aromatic Rice(Basmati3), Aromatic Short Grain (5), Short grain (3) and other HYV (10)) of Rice (*Oryza sativa* L.) obtained from different ecosystem of ACRIP (IIRR), Rajendranagar, Hyderabad, The nursery was sown 2^{nd} week of June every year. After 25 days, seedlings transplanted in the main field in Randomized Block Design in three replications with a spacing of 20 x 15 cm. Single plant observations were recorded on five plants selected at random per genotype per replication for characters viz., plant height (cm), number of productive tillers per plant, panicle length (cm), number of total grains per panicle, test weight and grain yield (kg/ha) and their means were used for statistical analysis. However, observations on days to 50% flowering were recorded on plot basis and all grain quality parameters viz., Hulling, mulling, head rice recovery, kernel length. Kernel bright, L/B ratio, ASV, AC, GC and aroma for the grains done as per IIRR, Hyderabad laboratory manual on rice grain quality procedures.

1000 Seed weight from each treatment were subjected to test weight. Quality characteristics of milled rice:

The quality characteristics of milled rice are classified both physically, and chemically. Reviewed the following terms before reading about physical and chemical characteristics of milled rice:

• Paddy or rough rice = similar term for paddy, or rice retaining its husk after threshing.

• Brown rice or husked rice = paddy from which the husk has been removed.

• Milled rice = rice after milling which includes removing all or part of the bran and germ from the husked rice.

• Head rice = milled rice with length greater or equal to three quarters of the average length of the whole kerne Kernel length (mm) of ten dehusked whole kernels

• Large broken = milled rice with length less than three quarters but more than one quarter of the average length of the whole kernel.

• Small broken or "brewers rice" = milled rice with length less than one quarter of the average length of the whole kernel.

• Whole kernel = milled rice grain without any broken parts.

• Milling recovery = percentage of milled rice (including broken) obtained from a sample of paddy.

• Head rice recovery = percentage of head rice (excluding broken) obtained from a sample of paddy.

If part of the milled rice kernel is opaque rather than translucent, it is often characterized as “chalky”. Chalkiness disappears upon cooking and has no effect on taste or aroma, however it downgrades milled rice. Excessive chalkiness is caused by interruption during the final stages of grain filling.

Starch makes up about 90% of the dry matter content of milled rice. Starch is a polymer of glucose and amylase, a linear polymer of glucose. The amylose content of starches usually ranges from 15 to 35%.

High amylose content rice shows high volume expansion (not necessarily elongation) and high degree of flakiness High amylose grains cook dry, are less tender, and become hard upon cooling. In contrast, low-amylose rice cooks moist and sticky. Intermediate amylose rice are preferred in most rice-growing areas of the world, except where low-amylose japonicas are grown. Based on amylose content, milled rice is classified in “amylose groups”, as follows:

• waxy (1-2% amylose),

• very low amylose content (2-9% amylose),

• low amylose content (10-20% amylose),

• intermediate amylose content (20-25% amylose) and

• high amylose content (25-33% amylose). Amylose content of milled rice is determined by using the colorimetric iodine assay index method,

Gel consistency measures the tendency of the cooked rice to harden after cooling. Within the same amylose group, varieties with a softer gel consistency are preferred, and the cooked rice has a higher degree of tenderness. Harder gel consistency is associated with harder cooked rice and this feature is particularly evident in high-amylose rice. Hard cooked rice also tends to be less sticky. Gel consistency is determined by heating a small quantity of rice in a dilute alkali.

Aroma 5 g of rice sample was taken in conical flask then 15 ml of distilled water was added, soaked for 10 min and cooked for 15 min, transferred into a Petri dish and placed in refrigerator for 20 min. Then the cooked rice was smelled by a random panel: Strongly Aromatic; slightly Aromatic; Non Aromatic. The statistical analysis of data obtained was carried out by Gomez and Gomez, 1984 method.

Results and Discussion

Data on yield characters in basmati lines Pusa Basmati 1 significantly higher 3672 kg/ha followed by Pusa 1121(3488 kg/ha.), Ketki Joha (ASG) yield 3683 kg/ha. followed by Shobini 3620, Swarna-Sub 1 (MS) yield was 6063 kg/ha. followed by Swarna 5750 kg/ha. and other HYB NDR 359 (5475kg/ha.) followed by PA 6444 (5325 kg/ha.). The yield due to significantly higher due to more no. of EBT, more no. of grain/panicle. Test weight was recorded maximum in IR 64 (27.2 g) followed by NDR 359 (26.9 g) and minimum was recorded in Pusa basmati 1 (15.8 g).

Variations in test weight are closely related with findings of Kanchana *et al.,* (2012) and Babu *et al.,* (2013). The milling per cent ranged from 65.70 to 72.20. Maximum milling percentage was recorded in Pusa RH 42 (73.07) followed by MEPH 113 and minimum was recorded in Ketiki Joha 72.20% followed by MTU 1153 (71.60%). Head rice recovery per cent ranged from 47.30 to 68.20. Head rice recovery per cent was recorded maximum in MTU 1010 (68.20) followed by Swarna-Sub 1 (67.20) and minimum was recorded in Vandana (47.30).

Variation in head rice recovery in different varieties is closely related with moisture content and force of the milling machine. Kernel length of the rice varieties were ranged from 4.16 to 8.25 mm. The kernel length was recorded maximum in Pusa 1121 (8.25 mm) followed by Pusa basmati (7.19 mm) and minimum was recorded in Chittimuthyalu (4.16 mm). It was found that kernel breadth ranged from 1.67 to 2.52 mm. Maximum kernel breadth was recorded in Savithri (2.52 mm) followed by Jaya (2.41 mm) and minimum kernel breadth was recorded in Pusa basmati 1 (1.67 mm).

Kernel breadth of Savithri was significantly superior among all the varieties. The variations in kernel breadth in different varieties may be due to its genetic characteristics. L/B ratio was recorded highest in Pusa basmati 1 (4.30) followed by Pusa 1121 (4.29) and minimum was recorded in Savithri (1.91). Grain classification of the rice varieties is depicted in Table 2. Maximum amylose content was recorded in NDR 359 (27.01) followed by Dubraj (26.48 mm) and minimum amylose content was recorded in MTU 1153 (18.92). Gel consistency maximum was recorded in MTU 101 (70) followed by IR 64, MTU 1153,PA 6444 and Sahbhagi Dhan (56) and minimum was recorded in Gontra Bidhan 3, Swarna, Pusa 1121, Tarori Basmati and Chittimuthyalu (22).

Aroma is an important trait, has high demand in the global market. The native varieties studied during this investigation showed the presence of aroma, for which these varieties are preferred by local people for consumption. Strong aroma was recorded in Basmati lines and Kalanamak. Nadaf *et al.,* (2007) reported that Basmati rice contains more aroma than the traditionally cultivated scented rice varieties.

Table.1 Yield and yield contributing characters of rice

Sl No.	Variety	Days to 50% Flowering			Plant Height (cm)			Ebt/m2			Total grain/panicle			Test weight (g)			Yield kg/ha.		
		2017	2018	Mean	2017	2018	Mean	2017	2018	Mean	2017	2018	Mean	2017	2018	Mean	2017	2018	Mean
1	Sahbhagi Dhan	70	72	71	101	105	103	246	249	248	210	221	216	22.6	2.3	12.5	4340	4500	4420
2	Vandna	67	69	68	89	84	87	215	222	219	189	193	191	23.7	22.4	23.1	3260	3310	3285
3	Swarna-Sub 1	121	123	122	89	93	91	340	356	348	245	256	251	19.8	20.1	20.0	5975	6150	6063
4	PA 6444	117	120	119	105	109	107	266	261	264	241	226	234	24.1	23.9	24.0	5210	5440	5325
5	Savithri	125	127	126	107	112	110	246	269	258	234	222	228	18.8	18.4	18.6	4260	4500	4380
6	MTU 1153	101	105	103	115	121	118	236	245	241	223	231	227	23.6	2.4.8	23.6	3710	3910	3810
7	IR 64	85	87	86	101	107	104	222	248	235	201	207	204	27.5	26.9	27.2	3260	3310	3285
8	MTU 1010	78	75	77	109	103	106	241	249	245	199	207	203	22.2	24.4	23.3	3560	3740	3650
9	Gontra Bidhan 3	81	83	82	107	109	108	256	245	251	211	219	215	23.9	24.6	24.3	4710	4460	4585
10	NDR 359	101	103	102	126	138	132	301	313	307	256	267	262	26.9	26.8	26.9	5440	5340	5390
11	JAYA	99	101	100	120	126	123	274	278	276	213	219	216	24.4	23.7	24.1	4210	4460	4335
12	Swarna	124	126	125	140	136	138	321	328	325	256	249	253	19.6	18.9	19.3	5689	5810	5750
13	BPT 5204	112	115	114	78	82	80	313	319	316	236	254	245	16.8	17.2	17.0	5210	5440	5325
14	Pusa Basmati 1	99	96	98	115	110	113	241	263	252	213	215	214	15.6	16.0	15.8	3610	3733	3672
15	Pusa 1121	97	95	96	111	115	113	249	257	253	219	210	215	16.4	15.9	16.2	3460	3515	3488
16	Tarori Basmati	101	105	103	136	140	138	229	231	230	187	185	186	16.1	15.8	16.0	3100	3240	3170
17	Dubraj	117	120	119	125	132	129	236	241	239	176	173	175	17.3	16.9	17.1	3590	3640	3615
18	Ketki Joha	120	122	121	127	120	124	241	254	248	187	182	185	17.9	18.2	18.1	3610	3756	3683
19	Shobini	115	118	117	124	128	126	256	249	253	203	207	205	18.4	18.6	18.5	3550	3690	3620
20	Kalanamak	123	125	124	156	163	160	236	241	239	217	221	219	18.9	19.4	19.2	2960	3150	3055
21	Chittimuthyalu	126	129	128	141	136	139	244	228	236	203	207	205	19.1	18.7	18.9	2800	2925	2863

Table.2 Grain quality analysis of rice

Sl No.	Variety	Hull%	Mill%	HRR%	KL(mm)	KB(mm)	L/B ratio	Grain Type	Grain Chalk	ASV	AC	GC	Aroma
1	Sahbhagi Dhan	75.00	66.50	55.10	5.61	2.28	2.46	SB	VOC	7	21.44	56	NS
2	Vandna	77.10	67.20	47.30	5.63	2.13	2.64	MS	VOC	4	24.05	42	NS
3	Swarna-Sub 1	77.80	70.10	67.20	5.20	2.24	2.32	SB	VOC	4	24.22	55	NS
4	PA 6444	78.80	69.70	53.70	6.28	2.19	2.86	LB	VOC	4	23.43	56	NS
5	Savithri	79.80	70.00	66.90	4.83	2.52	1.91	SB	VOC	4	25.50	35	NS
6	MTU 1153	79.60	71.60	59.70	5.96	2.05	2.90	MS	VOC	4	18.92	56	NS
7	IR 64	77.70	67.90	57.00	6.48	2.13	3.04	LS	VOC	4	24.55	56	NS
8	MTU 1010	78.00	69.80	68.20	6.11	2.01	3.03	LS	VOC	4	23.38	70	NS
9	Gontra Bidhan 3	77.20	66.20	59.70	5.35	2.24	2.38	SB	VOC	4	25.78	22	NS
10	NDR 359	79.80	70.10	52.50	6.35	2.36	2.69	LB	VOC	4	27.01	41	NS
11	JAYA	80.30	71.40	65.10	5.51	2.41	2.28	SB	VOC	7	25.54	24	NS
12	Swarna	78.30	67.10	52.80	5.44	2.26	2.40	SB	OC	4	24.07	22	NS
13	BPT 5204	78.40	69.60	62.00	5.17	2.04	2.53	MS	VOC	4	24.61	25	NS
14	Pusa Basmati 1	76.10	67.90	51.70	7.19	1.67	4.30	LS	VOC	7	24.05	24	SS
15	Pusa 1121	75.90	68.70	58.40	8.25	1.92	4.29	LS	VOC	7	23.29	22	SS
16	Tarori Basmati	77.70	69.80	63.20	7.11	1.80	3.95	LS	VOC	5	22.93	22	SS
17	Dubraj	77.60	67.70	55.80	5.03	2.10	2.39	SB	VOC	4	26.48	43	SS
18	Ketki Joha	80.80	72.20	64.10	5.24	1.84	2.84	MS	VOC	7	24.02	47	MS
19	Shobini	78.30	65.70	53.20	5.51	1.74	3.16	SS	A	4	24.14	24	SS
20	Kalanamak	75.60	66.50	58.40	4.96	1.94	2.55	MS	VOC	4	24.25	53	MS
21	Chittimuthyalu	75.60	69.10	61.40	4.16	2.06	2.01	SN	A	4	23.70	22of	MS

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