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Evaluation of Rice Varieties of different Ecologies for Grain Quality Characters

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ABSTRACT: Grain quality characters in rice are very important so far as consumers preference is concerned. In India, quality characters were not taken in to consideration during varietal development and release. Realising the importance, now quality characters are given priority during varietal release.
Ninety nine released rice varieties for different states and ecologies *viz*, upland (18), irrigated (41) and lowland (40) were analysed for 12 grain quality traits. These varieties were grown in the farm of National Rice Research Institute, Cuttack and analysed after 3 months of harvest for Hulling%, Milling% HRR% Kernel length(mm), Kernel breadth (mm), L/B ratio, Alkali spreading value, Water uptake, Elongation ratio, Volume expansion ratio, Kernel length after cooking and amylose content. The Hulling (%) is very important for the millers and it ranged from 74.5 (PR113) to 81.3 (Improved Lalat). HRR% ranged from 42.5 (Konark) to 72.0 (Bhanja). Kernel length varied from 4.8 (Sarasa) to 7.2 (Bhanja). Similarly low value of kernel breadth is preferred by consumers. Water uptake ranged from 77.5 (WGL 32100) to 342.5 (PR116). Amylose content ranged from 20.65 (Sankar) to 27.9 (Purnendu). High CV is observed in alkali spreading value (5.95) followed by volume expansion ratio (5.68).

Keywords: Grain quality characters, rice varieties, different ecology.

INTRODUCTION

Rice is the staple food for more than half of the world population and number one human food crop in the world (Itani, 2002). Rice plays an important role in Indian food and livelihood security system. India is the second most populous nation. It stands first in rice areas and second in production followed by China. In India, rice occupies 44.6 Mha areas. It is grown in all continents covering all agro-climatic zones. This wide adaptation leads to evolution of thousands of varieties having diverse cooking and eating characters. Before 2000AD, priority was given for increase in production and productivity to meet the food requirement of the growing population. After that, India became self sufficient and paddy surplus country. People became more concerned about quality than quantity. Previously bred varieties are mostly bold grain, which people do not like. India has released 705 varieties without testing quality characters. Now quality characters are considered during the varietal development and release. Quality is very important determinant of market price, consumer acceptance and end users. Consumers preference depend on appearance, milling and cooking process, grain shape and size. Grain quality in rice is determined by grain appearance nutritional value, cooking and eating quality (Juliano *et al*., 1990). Good grain quality fetches high market price. Demand for better quality is increasing day by day in developing and developed countries. Now quality is an important breeding objective in all rice breeding programme. Sobha Rani *et al.* (2008) evaluated the quality characters of 78 varieties of India. There after 28 land races of Assam were evaluated by Das and Borah, (2008). Realising the importance, Bhonsle and Sellapan (2010) evaluated 22 traditional varieties of Goa for their physico-chemical characters. Vanaja and Babu (2006) studied 56 high yielding varieties of Kerala. Shrivastava *et al.* (2012) also evaluated 12 genotypes of Faizabad. Subudhi *et al.* (2012) also evaluated 42 released varieties of Odisha for their quality characters. Asis *et al.* (2006) studied 55 rice varieties and hybrids for grain quality characters. Biswas *et al.* (1992) evaluated rice varieties and land races of Bangladesh for grain quality characters. Ninety two elite varieties of India were evaluated by Nirmaladevi *et al.* (2015). It is evident that there is no systematic study of quality characters for released varieties of India except some fragmentary report. Now attempts have been made to evaluate the released varieties for their quality characters to find out donors for hybridisation popularisation and development of database. In the preliminary study, 99 genotypes of different states and of different ecologies were evaluated in this study.

MATERIALS AND METHODS

The experiment was conducted in the farm of National Rice Research Institute, Cuttack during kharif 2018. Ninety nine released rice varieties of different states for

different ecologies *viz*, upland (18), irrigated (41) and lowland (40) were transplanted in RBD design with two replications. These include four scented varieties *viz.*, Pusasugandha-3, Basmati-1, Pusa sugandha-2 and Bindli and four gene pyramided line viz., Swarm MAS, Lalat MAS, IR-64 MAS and IR 64 SUB-1 and saline varieties also 25 days old seedlings were transplanted with spacing 15 × 20cm. The recommended dose of N:P:K (80:40:40) were applied. All the recommended agronomic practices were followed.

Methods:

After 3 months of harvest, Samples were cleaned thoroughly using winnower to remove chaff and other foreign matters and dried up to 12-14%moisture content. Analysis of all quality traits were done in two replications.

Physical properties:

Kernellength, kernel breadth, and length breadth ratio were measured by dial micrometer (Ramiah, 1969). Hulling % and Milling % were done by using standard rice huller (Satake Thuza) and rice polisher (Satake TMO5A) respectively .After cleaning and weighing the dehusked kernel(brown rice), Hulling % was calculated. Dehusked kernel were polished to remove bran and Milling % was calculated. Head rice recovery (%) were calculated (Govindswamy and Ghosh 1969).

Chemical properties: Alkali spreading value was analysed following Little *et al*. (1958). Amylase content was studied following Juliano (1971).

Cooking characters: Water uptake and Volume expansion ratio were done following Anonymous (2004), Beachell and Stanse (1963). Similarly kernel length after cooking and elongation ratio were measured following Azeez and Shafi (1966). All the pooled data were analysed following Gomez and Gomez (1984); Singh and Choudhury (1982).

RESULT AND DISCUSSIONS

The analysis of variance showed highly significant difference for all the 12 quality characters (Table 1). The rice millers prefer varieties with high milling (%) and head rice recovery. But consumers prefer good cooking and eating quality (Merca and Juliano, 1981). The hulling (%) is very important for the millers and it ranged from 74.5 (PR113) to 81.3 (Improved Lalat). High HRR(%) provides more profit to the consumers and millers and It depends on the varieties, grain type, cultural practices and drying conditions (Asis, 2006). HRR(%) is heritable and very easy to improve (Jenning *et al.*, 1979). It depends on environmental factors and post harvest handling (Fan *et al*., 2000). It ranged from 42.5 (Konark) to 72.0 (Bhanja). Grain shape and size are classified depending on SES score IRRI (1996). Consumer preferences depend on grain length and thickness. Now elite consumers prefer medium slender grains. Kernel length varied from 4.8 (Sarasa) to 7.2 (Bhanja). Similarly low value of kernel breadth is preferred by consumers. Bold grains are not liked by elite class. Kernel breadth varied from 1.75 (Krishnahamsa) to 2.76 (Golak). More water uptake require more energy to cook. So Less water uptake will be preferred and it ranged from 77.5 (WGL 32100) to 342.5 (PR116) showing very wide variability. High KLAC looks good in appearance and taste. It ranged from 8.45 (Golak) to 14.75 (PR 114). Intermediate amylase content (20-25%) is usually preferred by Indians and consumed by eastern India people. It ranged from 20.65 (Sankar) to 27.9 (Purnendu). Most of the varieties are having intermediate amylase (20-25%) content except WITA-8, VLD 61, VLD 221, CSR 4, PR 115, GR 4, GR 103, WGL 32183, ASD 16, Golak. Similar results were observed by Panwar *et al*. (1997); Sarawagi *et al*. (2000); Gannamani (2001); Subudhi *et al.* (2009).

In upland, the varieties like Annaporna, Prasan, Lalitgiri, Sebati are having HRR > 60%. The elongation ratio is more than 2 in Anjali. Amylose content is intermediate in all varieties except WITA-8(26.0), VLD 61(25.9). KLAC is high in Anjali (12.25) followed by Sankar (11.8).

Table 1: Analysis of variance (Mean square) of 12 grain quality traits.

Characters	**Replication**	**Treatment**	**Error**
Hull(%)	60.390	5.01**	1.69
Mill(%)	40.230	17.56**	3.55
HRR(%)	54.60	83.68**	5.45
KL(mm)	0.060	0.479**	0.040
KB(mm)	0.075	0.110**	0.007
L/B	0.093	0.319**	0.017
ASV	0.661	4.160**	0.085
WU	941.78	8399.83**	62.18
VER	0.123	0.069(ns)	0.051
KLAC	0.020	2.411**	0.117
ER	0.009	0.046**	0.003
AC(%)	10.552	4.607**	0.514

Water uptake is high in Virendra (240) and lowest in Annaporna (95). Low water uptake is good for consumers as it requires less energy. The detailed are presented in Table 2. In irrigated varieties, HRR is high (>60%) in PR118, PR115, GR-4, IR64, ASD 16. Poorva, Tapaswini, Gouri and Hema. Elongation ratio is more than 2.0 in PR 114. Amylose content is >25% in PR118, PR116, GR103, IR64, MAS, WGL32100, Lalat etc. KLAC is high in PR114(14.75), CSR27(13.3). Water uptake is high (>300) in Bhoi, Samant, PR116, Pusa Sugandh-3 and CSR 27.In lowland, the varieties *viz*., Gurjari, Mahsuri, Sudhir, Jagannath, Golak, Utkalprava, Rajashree, Matangini, Sabita, Sonamani, Manik, Indravati, Shravani, Jagabandhu, Birupa, Surendra, Bhanja, Rajashree, Mahalaxmi are having HRR% > 60. Long grain

(>6.5mm) are observed in Moti, Sudhir, Utkal Prava, Matangini, Sabita, Sonaman. Elongation ratio is high (>2.0) in Sashi, Sudhir, Ramakrishna etc.

Table 2: Name of 99 rice varieties with their 12 grain quality characters.

Sr. No.	Variety name	Hull(%)	Mill(%)	HRR(%)	KL(mm)	LB(mm)	L/B	ASV	WU	VER	KLAC	ER	AC(%)
						Upland							
1.	Annaporna	77.00	70.60	63.50	5.21	2.02	2.57	4.00	95.0	4.12	10.0	1.91	20.41
2.	Abhisek	79.75	68.25	53.00	5.27	2.45	2.14	3.25	137.5	3.87	9.8	1.8	25.05
3.	Suphala	78.00	71.0	47.00	5.19	1.99	2.61	4.50	187.5	4.0	9.7	1.86	23.4
4.	Sankar	80.00	71.50	58.00	6.00	2.35	2.57	5.26	132.5	3.87	11.8	1.97	20.0
5.	Prasan	79.5	66.5	60.0	5.42	2.58	2.08	3.25	95.0	3.75	9.8	1.8	21.25
6.	Virendra	77.0	70.5	52.0	6.0	2.37	2.52	7.0	240.0	3.75	10.95	1.82	25.0
7.	Anjali	76.0	66.0	49.0	5.51	2.28	2.32	5.25	145.0	4.25	12.25	2.25	24.5
8.	Lalitagiri	79.0	71.25	64.3	5.6	2.46	2.23	6.0	120.0	4.1	9.2	1.64	24.15
9.	Udaygiri	79.5	69.5	45.5	5.37	2.52	2.13	3.5	157.5	3.87	10.3	1.9	23.7
10.	Khandagiri	78.0	70.0	50.5	6.24	2.01	3.1	5.5	140.0	3.87	10.5	1.69	22.5
11.	Ghanteswari	74.5	61.0	57.0	5.44	2.48	2.19	4.0	140.0	3.75	8.95	1.65	22.9
12.	Pathara	78.0	70.5	48.5	6.1	2.36	2.58	7.0	257.5	3.87	10.2	1.67	22.79
13.	Nilgiri	77.0	69.5	48.0	5.43	2.43	2.23	5.0	110.0	3.75	9.8	1.8	22.3
14.	Jogesh	79.0	72.0	55.5	6.42	2.49	2.58	5.0	115.0	3.87	10.7	1.66	22.4
15.	Sebati	79.5	74.0	69.5	5.43	2.17	2.52	5.25	102.5	3.75	9.6	1.75	22.85
16.	WITA-8	78.25	66.00	52.75	5.75	1.92	2.99	3.00	115.0	4.0	10.3	1.70	26.0
17.	VLD-221	77.75	68.00	56.00	5.30	2.52	2.10	3.00	122.5	4.25	10.0	1.88	25.7
18.	VLD-61	78.00	69.00	53.00	5.46	2.15	2.51	6.75	172.5	3.87	9.3	1.70	25.9
						Irrigated							
19.	Improved Lalat	81.25	70.50	54.00	6.58	2.13	3.08	5.00	136.0	3.87	9.0	1.79	24.85
20.	CSR-27	77.75	66.25	54.50	7.15	2.02	2.52	7.00	305.5	4.37	13.3	1.97	21.49
21.	CSR-4	75.75	66.75	59.75	5.90	2.22	2.64	4.00	287.5	3.87	10.6	1.8	26.0
22.	Pusa Sugandh-3	79.00	67.00	54.00	6.23	2.10	2.97	5.25	310.0	4.00	10.9	1.75	21.0
23.	PR118	80.00	69.50	62.50	6.17	2.21	2.92	6.75	210.0	3.87	9.8	1.59	25.7
24.	PR-115	76.00	66.00	61.00	6.52	1.90	3.43	7.25	245.5	4.12	11.55	1.82	25.0
25.	PR-116	81.00	71.25	55.00	6.24	2.48	2.51	7.00	342.5	4.12	11.35	1.8	27.1
26.	PR-114	76.50	64.00	54.75	6.60	1.92	3.44	7.25	305.1	4.47	14.75	2.23	25.6
27.	PR-113	74.50	70.00	55.00	6.54	1.95	3.36	6.75	217.5	4.10	11.8	1.8	24.15
28.	Pusa Basmati-1	76.75	69.75	59.00	6.25	2.25	2.76	3.00	265.0	4.12	10.85	1.73	25.9
29.	Pusasugandh-2	78.00	66.00	59.00	6.69	1.85	3.61	7.25	260.0	4.0	11.0	1.65	22.26
30.	Gr-4	77.25	65.00	67.50	5.95	2.03	2.92	3.00	115.0	4.0	10.5	1.76	22.28
31.	Gr-103	77.25	70.50	56.00	6.06	2.19	2.75	2.75	165.0	4.25	9.85	1.67	27.10
32.	IR-64MAS	80.50	66.00	52.00	6.17	2.16	2.87	5.25	107.5	3.87	11.0	1.78	27.86
33.	IR-72	76.75	68.50	52.00	5.90	2.97	2.99	3.26	110.0	3.87	9.8	1.66	25.6
34.	IR-64 SUB-1	77.75	66.50	55.00	6.22	2.05	3.09	3.25	115.0	4.0	9.5	1.36	22.3
35.	IR-50	77.25	70.50	57.00	6.36	2.04	2.12	3.50	152.5	4.0	9.3	1.45	23.57
36.	IR-64	79.50	69.00	65.50	5.46	1.95	2.78	3.00	92.0	3.75	10.3	1.88	24.55
37.	WGL32183	78.75	65.50	56.50	6.17	1.95	3.16	3.25	95.0	4.25	10.4	1.63	27.05
38.	WGL32100	80.50	67.00	57.00	6.00	2.35	2.58	3.25	77.5	3.87	10.45	1.74	27.3
39.	ASD-16	77.00	66.75	61.50	5.17	2.16	2.39	4.00	132.5	4.12	10.3	1.99	20.85
40.	Rasi	80.50	69.50	59.00	6.02	2.09	2.88	5.25	95.0	3.75	10.8	1.75	26.6
41.	Poorva	78.25	72.00	65.50	5.51	2.20	2.49	5.75	210.0	4.0	9.3	1.68	24.95
42.	Krishna hamsa	79.25	74.00	58.00	6.30	1.75	3.58	3.00	112.5	4.0	11.0	1.74	23.8
43.	Sarasa	79.00	71.50	54.00	4.77	2.23	2.15	4.00	110.0	3.87	9.4	1.95	23.0
44.	Tapaswini	78.5	74.5	60.0	5.46	2.45	2.25	5.0	127.5	4.25	9.0	1.7	23.95
45.	Gouri	79.8	74.75	67.5	5.27	2.33	2.24	7.0	237.5	3.87	8.8	1.68	23.7
46.	Hema	77.5	71.5	63.0	5.3	2.36	2.24	4.5	187.5	3.75	8.8	1.66	23.7
47.	Sarathi	78.0	73.5	52.5	5.41	2.44	2.21	7.0	136.0	3.87	10.15	1.88	24.12
48.	Pratap	79.0	72.5	62.0	5.35	2.51	2.13	5.0	135.0	4.0	9.15	1.71	23.1
49.	Bhoi	79.5	74.5	64.5	5.45	2.73	2.52	7.0	305.0	4.0	10.35	1.89	22.9
50.	Konark	79.0	72.0	42.5	6.57	2.18	3.0	5.0	122.5	3.87	11.6	1.76	23.2
51.	Jajati	78.5	71.5	59.5	6.3	2.49	2.53	5.0	145.0	4.0	10.05	1.59	24.38
52.	Samanta	79.0	73.0	52.0	5.21	2.74	1.9	7.0	305.0	4.12	10.25	1.97	23.8
53.	Keshari	79.0	71.0	52.5	5.14	2.15	2.38	5.75	142.5	3.87	9.35	1.82	23.8
54.	Bhavani	79.0	74.0	69.0	5.47	2.59	2.11	7.0	277.5	4.0	10.75	1.96	23.03
55.	Daya	75.5	71.0	44.5	5.35	2.3	2.32	7.0	255.0	4.0	9.5	1.76	22.2
56.	Meher	80.0	75.5	65.0	6.37	2.47	2.58	5.25	185.0	3.87	11.85	1.86	21.9
57.	Gajapati	78.5	74.5	64.5	6.2	2.23	2.78	7.0	287.5	3.87	10.7	1.72	21.7
58.	Pratikhya	79.5	75.5	69.0	6.2	2.24	2.75	5.5	162.5	3.75	10.1	1.64	23.6
59.	Lalat	78.0	69.5	58.5	6.7	2.15	3.09	5.0	122.5	4.12	11.35	1.7	26.5
						Lowland							
60.	Moti	75.50	69.00	53.00	6.47	2.12	3.04	2.75	132.5	4.25	11.3	1.75	23.1
61.	Gurjari	80.50	72.50	65.00	6.32	2.27	2.77	3.00	112.5	3.75	11.3	1.86	26.0
62.	Mahsuri	78.50	71.50	64.50	5.25	2.02	2.60	3.00	132.5	4.0	9.35	1.78	24.3
63.	Sudhir	78.00	69.00	60.00	6.55	2.07	3.10	3.50	172.5	3.37	13.45	2.06	23.3
64.	Sashi	77.00	70.00	51.50	5.09	2.16	2.37	3.50	210.0	4.75	10.2	2.3	24.1
65.	Bhuban	79.75	71.75	54.50	5.84	2.58	2.25	3.25	140.0	4.52	10.5	1.85	25.1
66.	Bindli	76.00	70.75	64.00	5.02	2.15	2.32	3.00	152.5	4.12	12.4	2.43	21.2
67.	Ramakrishna	76.00	68.00	52.00	5.40	2.40	2.25	3.21	137.0	3.75	10.6	2.0	23.2
68.	Jagannath	77.00	71.75	60.00	5.22	2.23	2.35	3.00	205.0	4.25	9.6	1.84	24.2
69.	Golak	78.50	72.00	66.00	5.45	2.76	1.97	3.00	132.5	4.25	8.5	1.56	26.25
70.	Utkalprava	78.50	72.00	63.50	6.35	1.99	3.20	4.00	127.5	3.75	11.58	1.82	24.25
71.	Nalini	81.00	72.75	50.00	5.30	2.37	2.25	5.00	107.5	4.25	10.4	1.96	22.5
72.	Lalchandan	78.0	73.50	67.00	5.15	1.98	2.58	3.25	105.0	4.1	9.3	1.8	23.9
73.	Sambhamahsuri	74.5	67.3	55.0	5.7	1.77	3.21	5.0	110.0	4.25	10.4	1.66	25.05

74.	Dinesh	79.0	67.25	54.0	5.5	2.68	2.05	4.25	170.0	3.87	9.35	1.7	23.9
75.	Tripti	75.25	65.75	53.0	6.10	2.07	2.96	6.75	240.0	4.25	11.65	1.91	22.75
76.	Rajashree	79.0	73.0	65.0	5.7	2.57	2.25	3.0	83.0	3.87	9.45	1.66	23.0
77.	Swarn MAS	79.25	71.00	59.00	5.58	2.65	2.10	5.25	142.5	4.0	9.5	1.72	24.95
78.	Matangini	80.75	73.50	62.00	6.34	2.15	2.95	5.00	132.5	3.87	10.9	1.71	25.96
79.	Mandyavijay	77.00	70.50	57.25	5.23	2.27	2.30	3.00	111.5	4.0	9.45	1.8	25.79
80.	Sabita	77.0	71.0	68.0	6.46	2.28	2.58	4.0	135	3.87	9.50	1.5	23.6
81.	Sonamani	78.5	72.0	69.0	6.5	2.1	2.5	4.5	117.5	4.25	10.5	1.89	24.3
82.	Salivahan	81.0	72.5	59.0	5.65	2.5	2.43	4.2	125.0	3.87	9.55	1.69	23.5
83.	Purnendu	77.0	64.5	55.0	5.6	2.09	2.64	5.25	95.0	3.87	11.10	1.98	27.9
84.	Manik	79.5	72.0	63.0	5.34	2.38	2.24	7.0	135.0	3.87	8.85	1.65	24.0
85.	Kanchan	76.5	68.5	55.0	5.25	2.04	2.59	5.0	142.5	4.0	9.15	1.74	23.5
86.	Indravati	77.0	72.0	68.0	5.63	2.52	2.23	5.25	115.0	4.0	9.7	1.72	24.32
87.	Shravani	78	73.5	68.5	5.52	2.02	2.73	4.50	100.0	3.75	8.45	1.53	23.76
88.	Jagabandu	79.5	75.5	63.0	5.29	2.67	1.92	5.26	122.5	3.87	9.4	1.78	24.55
89.	Birupa	79.0	75.0	68.5	6.24	2.63	2.37	7.0	247.5	3.75	10.55	1.69	22.65
90.	Urbasi	79.5	73.0	68.0	5.36	2.42	2.22	3.5	145.0	4.0	9.05	1.69	22.5
91.	Rambha	78.5	74.0	52.5	5.88	2.56	2.29	5.0	147.5	3.75	10.05	1.7	23.5
92.	Surendra	77.5	69.5	61.5	5.65	2.35	2.40	5.5	107.5	4.0	9.1	1.61	22.5
93.	Prachi	74.5	69.0	67.0	5.54	2.39	2.32	5.25	135.0	3.87	9.1	1.64	23.5
94.	Bhanja	79.5	76.0	72.0	5.78	2.45	2.35	7.0	205.0	3.75	9.45	1.63	22.5
95.	Ramachandi	79.5	73.5	55.5	5.26	2.08	2.5	5.25	162.5	3.98	9.2	1.75	22.65
96.	Rajeswari	79.5	69.5	61.0	6.1	2.6	2.34	7.0	222.5	3.75	10.9	1.79	23.2
97.	Mahanadi	77.0	70.0	61.5	5.2	2.4	2.2	5.3	147.5	4.12	8.7	1.66	23.6
98.	Mahalaxmi	77.0	73.0	65.0	5.57	2.48	2.04	5.75	147.5	3.87	8.65	1.7	23.6
99.	Uphar	77.0	72.5	64.0	5.6	2.36	2.37	6.0	112.5	3.75	9.65	1.72	24.05
	Mean	78.17	70.4	58.6	5.77	2.26	2.58	4.9	164.7	3.97	10.25	1.78	24.04
	CV	1.66	2.67	3.98	3.46	3.8	5.12	5.95	4.78	5.68	3.34	3.47	2.98
	S.E	0.92	1.33	1.65	0.14	0.06	0.09	0.20	5.57	0.16	0.24	0.04	0.5
	CD(5%)	2.58	3.74	4.63	0.39	0.17	0.26	0.58	15.64	--	0.68	0.12	1.4
	CD(1%)	3.4	4.95	6.13	0.52	0.22	0.34	0.70	20.7	--	0.9	0.16	1.88

Table 3: Promising rice varieties for different quality characters.

Name of character		Name of varieties
Hulling (%)	>80	Sankar, Imp Lalat, PR 118, PR 116, Matangini, IR-64 MAS, WGL 321000, Salivahan, Rasi, Meher, Gurjari, Nalini.
HRR(%)	>65	Sebati, GR-4, IR 64, Poorva, Gouri, Bhoi, Bhavani, Gajapati, Gurjari, Golak, Rajashree, Sabita, Sonamani, Indravati, Shravani, Birupa, Urbasi, Mahalaxmi, Bhanja
Kernel length	>6.5mm	Imp Lalat, CSR 27, PR 115, PR 114, PR 113, Pusa sugandha-2, Lalat, Moti, Sudhir, Sabita, Sonamani
KLAC	>12mm	Anjali, PR114, CSR 27, PR 113, Sudhir, Bindli, Tripti.
ER	>2.0	Anjali, PR 114,Sudhir,Sashi,Bindli,Ramakrishna
L/B	>3.0	Khandagiri, Imp Lalat, PR 115, PR 114, PR 113, Pusa sugandha-2, Moti, Sudhir, Krishnahamsa, IR 64 SUB 1, Sambhamahsuri, Utkal Prava

CONCLUSION

The promising genotypes (Table 3) can be used in hybridisation programme for varietal development and can be popularised among the farmers.

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