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Short Communication

Seed Quality Assessment in Different Varieties of Paddy (*Oryza sativa* L.)

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Rice (*Oryza sativa* L. 2n = 24) belongs to the family *Graminae* is arguably the most important staple food crop in the world. More than half of the world's population consumes rice as their primary source of food and in future also it will certainly continue to use rice as main diet. Aromatic rice constitutes a small and rated as the best in quality and fetches much higher price than high quality non-aromatic rice in the international market. Thus aromatic rice has become an important commercial commodity. Almost every state in India has its own collection of non-Basmati aromatic rice genotypes with mostly short and medium sized grains. Aromatic genotypes predominantly have long growth duration, photoperiod sensitivity, low yields and susceptibility to lodging. Basmati rice is also known as 'Queen of Rice and Pearl of Rice'. All aromatic rice is not basmati. The average temperature required throughout the life period of the crop ranges from 21 to 37°C but the crop can tolerate the temperature upto 42°C. Minimum temperature for sprouting is10°C, at the time of tillering, the crop requires a high temperature than for growth. Minimum temperature for flowering range from 22-23°C. Temperature requirement for blooming is in the range of 26.5 to 29.5°C. Minimum temperature for grain formation from 20-21°C at the time of ripening the temperature should be between 20-25°C. Photo periodically, rice is a short-day plant. However, there are varieties which are non-sensitive to photoperiodic condition. Use of quality seeds of adapted and improved varieties is widely recognized as fundamental to increased crop production and productivity. Seed quality begins with selection of appropriate paddy cultivar to suite environmental conditions, management practices, and the end use of the rice [1]. Quality of foundation and certified seed depends on the quality of breeder seed used. Seed quality is affected by various factors at different developmental stage of the crops. Seed quality assessment in major paddy growing areas is very important to determine the planting value of seed produced in that area. As per IMSCS [2], minimum germination for paddy is 80%. Seed dormancy in paddy has been reported by many researchers from different countries. Due to the presence of dormancy in most of the rice cultivars, farmers often encounter poor germination. Dormancy in freshly harvested paddy seed leads to confusion, delay in germination and posing problem for immediate testing after harvest. Seed dormancy is a state in which seeds fail to germinate even under favourable conditions of moisture, temperature and oxygen for germination. Hence, it becomes necessary to study the presence of dormancy in paddy varieties before sowing. However, with the release of new varieties, it is become necessary to study the duration of dormancy period and to find out simple methods to break the dormancy to avoid poor germination problem. Use of quality seeds and selecting good cultivars are important to improve seedling establishment, reduce disease development and enhance productivity. Seedling vigor, an indicator of seedling size, health, and growth rate, is the product of several factors related to genetics and environmental influences [3]. Use of quality seeds and selecting good cultivars are important to improve seedling establishment, reduce disease development and enhance productivity. Keeping in view the above aspects, the present study was undertaken to evaluate different paddy varieties for seed quality parameters.

Freshly harvested twenty four seed lots of breeder seeds of different paddy varieties were collected from ICAR-IARI regional station Karnal and Rice Research Station,

Kaul (Kaithal) during December, 2020. The seed samples were evaluated for various seed quality parameters *viz.,* test weight (g), moisture content (%), germination (%), hard seeds (%), seedling length (cm), seedling dry weight (mg), vigour index-I and vigour Index-II in laboratory of Department of Seed Science & Technology, CCS Haryana Agricultural University, Hisar. The germination test was conducted by using 100 seeds in four replication at 25±1°C temperature and relative humidity 90±1 per cent. The seedlings were evaluated after fourteen days into normal seedlings, abnormal seedlings, fresh ungerminated seeds (hard seed) and dead seeds which were counted and expressed in percent according to the rules of International Seed Testing Association [4]. The seeds which did not absorb water and found as such at the end of the test were considered as hard seeds. The seedling length (cm) was measured by the average of ten normal seedlings of each replication. After measuring the seedling length, these ten fresh seedlings were taken and dried in a hot air oven for 24 h at 80±1^{0}C. The dried seedlings of each replication were weighed and average seedling dry weight was expressed in milligram. The seedling vigour indices were calculated using the following formula [5]:

Vigour index-I= Germination (%) × average seedling length (cm)
Vigour index-II= Germination (%) × average seedling dry weight (mg)

The moisture content of the seed samples was measured by ISTA recommended hot air oven method. Five gram ground seed sample was put at 130^{o}C±1^{o}C in oven for 2 hour. The sample was then removed from oven and put into desiccator for 35-45 min. and moisture was calculated by using following formula:

$$\text{SMC (\%), M} = \frac{M_2 - M_3}{M_2 - M_1} \times 100$$

Where, M_1=Weight of empty container with lid, M_2 = Weight of container with lid and seed before drying, and M_3=Weight of container with lid and seed after drying and cooling.

Table 1. Seed quality status in different paddy varieties

Variety	Test weight (%)	Moisture content (%)	Germination (%)	Hard seed (%)	Seedling length (cm)	Seedling dry weight (mg)	Vigour index-I	Vigour index-II
PB 1509 L_1	30.9	6.67 (14.96)	90.3 (72.2)	3.0	27.5	0.081	2489	7.3
PB 1509 L_2	30.1	6.77 (15.07)	67.0 (54.9)	25.3	26.6	0.086	1781	5.8
PB 1509 L_3	29.9	6.73 (15.03)	82.0 (64.9)	7.0	29.5	0.092	2416	7.5
P44 L_1	23.9	6.27 (14.49)	95.0 (77.1)	1.7	32.2	0.094	3060	8.9
P44 L_2	25.0	6.13 (14.33)	90.3 (72.2)	2.7	28.8	0.091	2601	8.2
PB 1121	26.3	6.83 (15.15)	83.0 (65.7)	7.0	30.0	0.087	2493	7.2
PB 1718	30.2	5.97 (14.13)	61.7 (51.8)	27.0	28.4	0.087	1753	5.4
PB 6	22.0	5.70 (13.81)	28.3 (32.1)	60.3	21.4	0.055	608	1.6
HKR 128	24.1	5.97 (14.13)	89.7 (71.5)	5.3	31.5	0.089	2828	8.0
Taraori Basmati	20.9	6.43 (14.69)	63.3 (52.7)	28.7	37.0	0.084	2345	5.3
Basmati 370	18.7	6.13 (14.33)	12.0 (20.1)	82.3	24.3	0.061	292	0.7
TYPE 3	18.5	6.53 (14.80)	20.0 (26.6)	73.3	15.1	0.067	296	1.3
HKR 46	23.4	6.93 (15.26)	87.7 (69.6)	1.7	34.2	0.097	2995	8.5
HKR127	23.4	6.07 (14.25)	86.3(68.4)	5.0	30.8	0.088	2656	7.6
PB 1121	27.0	6.57(14.84)	68.0 (55.6)	20.7	31.3	0.092	2129	6.2
CSR 30	20.3	6.97 (15.30)	30.0 (33.2)	55.7	25.3	0.068	759	2.0
Govind	21.4	6.10 (14.29)	88.3 (70.1)	3.0	32.2	0.082	2848	7.3
HKR120	26.3	6.53 (14.80)	91.7 (73.5)	3.0	33.2	0.095	3046	8.7
HKR47	23.6	7.23 (15.60)	79.3 (63.0)	5.7	32.0	0.096	2539	7.6
HKR 48	23.9	6.33 (14.57)	90.7 (72.3)	3.0	32.8	0.090	2971	8.2
HKR 126	27.0	5.93 (14.09)	86.3 (68.4)	4.0	33.3	0.106	2872	9.2
HB 2	24.9	6.57 (14.84)	69.7 (56.7)	15.0	30.3	0.084	2102	5.9
HB1	20.6	6.80 (15.11)	60.7 (51.2)	16.3	25.4	0.078	1547	4.8
IR 64	22.3	6.97 (15.30)	78.7 (62.5)	5.3	29.4	0.084	2310	6.6
CD (P=0.05)	1.4	0.27	6.5	3.25	3.99	0.009	234	0.9

Figures in parenthesis are angular transformed values, L_1, L_2 and L_3 are different lots of same variety

Table 2. Transplanting and harvesting date of different paddy varieties along with seed yield

Variety	Date of transplanting	Date of harvesting	Seed yield (q/ha)
PB 1509 L_1	18.07.20	18.10.20	56.0
PB 1509 L_2	16.07.20	17.10.20	56.0
PB 1509 L_3	15.07.20	17.10.20	58.0
P44 L_1	16.06.20	25.10.20	83.0
P44 L_2	14.06.20	24.10.20	81.0
PB 1121	04.07.20	02.11.20	45.0
PB 1718	04.07.20	03.11.20	56.0
PB 6	26.06.20	16.11.20	60.0
HKR 128	22.06.20	17.10.20	77.0
Taraori Basmati	24.07.20	30.10.20	37.9
Basmati 370	24.07.20	28.10.20	23.0
TYPE 3	08.07.20	11.10.20	32.0
HKR 46	24.06.20	08.10.20	55.0
HKR127	29.06.20	18.10.20	66.3
PB 1121	08.07.20	11.10.20	55.4
CSR 30	08.07.20	11.10.20	37.4
Govind	06.07.20	03.10.20	63.8
HKR120	24.06.20	08.10.20	60.0
HKR47	01.07.20	15.10.20	73.9
HKR 48	24.06.20	05.10.20	68.7
HKR 126	24.06.20	05.10.20	55.0
HB 2	26.06.20	25.10.20	55.9
HB1	08.07.20	11.10.20	41.0
IR 64	24.06.20	08.10.20	60.3

Test weight was calculated by taking the weight of 1000 seeds and expressed in grams. To know the duration of varieties, date of transplanting and date of harvesting were also recorded. The yield potential of the varieties was also recorded in quintal per hectare. The experiment was conducted in complete randomized block design (CRD) and the data were analyzed as per methods suggested by Panse and Sukhatme [6] and using the online statistical tool (OPSTAT) developed by Sheoran [7].

The results of the study revealed that significant variation was observed among varieties for all seed quality parameters studied. Maximum germination was recorded in variety P44 (95%) followed by HKR120 (91.7%) while minimum was recorded in Basmati 370 (12%). In Basmati 370 low germination was recorded due the presence of hard seeds (82.3%). Hard seeds were also found in TYPE 3 (73.3%), PB 6 (60.3%) and CSR 30 (55.7%). Use of seeds of these varieties just after harvesting may create problem to farmers, seed analysts and researchers. Presence of dormancy in these varieties might be due to genetic makeup of the seed, influence of the environment, immature embryos, seed coat impermeability to water and gases or mechanical restriction by seed coats, presence of inhibitors, physiological maturity and light sensitivity. [8] also evaluated paddy varieties for seed dormancy and reported that Surekha and Phalguna did not exhibit dormancy whereas four weeks dormancy was observed in CSR 18, Chaitanya and Krishnaveni; six weeks in Pusa Basmati and Basmati 370 and 7 weeks in Pakistan Basmati, CSR 13, RNR 32341 and WGL 48684. Test weight was recorded maximum in PB 1509 (30.9g), followed by PB 1718 (30.2g) and minimum was found in TYPE 3 (18.5g) which was at par with Basmati 370 (18.7g). Moisture content was found maximum in HKR 47 (7.2%) while minimum was found in variety PB 6 (5.7%). Seedling length was recorded maximum in Taraori Basmati (37.0cm) followed by variety HKR 46 (34.2cm) while minimum was recorded in TYPE 3 (15.1cm). Seedling dry weight was found maximum in HKR 126 (0.106mg) and minimum was recorded in PB 6 (0.055mg). Vigour index-I was found maximum in P44 (3060) which was at par with HKR 120 (3046) and minimum was recorded in Basmati 370 (292) which was at par with TYPE 3 (296). Vigour index-II was found maximum in HKR 126 (9.2) while minimum was recorded in Basmati 370 (0.7). It is clear from the study that test weight (seed size) is directly related with vigour content. TYPE 3 variety having lowest test weight (18.2g) resulted into minimum seedling length (15.1cm). Similarly Basmati 370 having less test weight (18.5g) results in lowest vigour index-II (0.7). [9] have supported these results who reported that seed germination and vigour index increased as the sieve size increased indicating bold size seed as more vigorous than small size seed. [10] also found that the genotypes having longer size seeds are superior in seedling vigor characters *i.e.* rapid emergence of radicle and plumule and higher biomass accumulation. Maximum seed yield was recorded maximum in P44 (83.0q/ha) followed by HKR 128 (77.0 q/ha) while it was minimum (32.0 q/ha) in Basmati 370 (Table 2). The duration of crop growth variety P44 and HKR 128 was found maximum which results in more photosynthesis and dry matter accumulation. The variation in yield and seed quality parameters among the varieties might be due to their genetic make, agronomic practices and environmental factors under which these were grown.

The information of the study will be helpful in preparation of atlas for quality seed production pockets or in delineation of areas for quality seed production. The

results will also be useful for seed industries as well as commercial food industries. Based on the performance of seed quality parameters and seed yield, it is concluded that variety P44 and HKR128 varieties are superior over the others and these can be used in further breeding progrmammes.

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