

Germination and Seed Vigour in Accelerated Aged Seeds of Rice (*Oryza sativa* L.)

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ABSTRACT Accelerated ageing test, a test for evaluating the vigour, viability and storability was employed for testing rice cultivars. For this ten cultivars of rice viz. Usar 1, Type 3, Ashwani, Mahsuri, Saket 4, Type 9, Sarju 52, Basmati 370, Prasad and NDR 118 were subjected to accelerated ageing for 0, 3, 5, 7, 9, 12, 15 and 20 days. The changes in germination, seedling length and seed vigour index was studied. These attributes were highly influenced by accelerated ageing and were significantly reduced with advancement of accelerated ageing. Minimum values were recorded after 20 days of accelerated ageing. The data recorded suggested that cultivar Saket 4, NDR 118 and Usar 1 had better germination, seedling length and seed vigour index can withstand well in adverse storage and field conditions during germination.

Keywords: *Oryza sativa*, germination, accelerated ageing, seedling length, seed vigour index.

The seed attains highest level of vigour and viability at the time of maturity. Changes which occur during storage and are associated with deterioration such as delayed germination, reduced seedling growth, decreased tolerance to adverse germination condition and loss of germinability have been reviewed [2]. The potential storage life of seed varies from species to species and within species among varieties and seed lots (3 & 4). Accelerated ageing is the most widely used stress tests to predict the storability of various crops seed in short period (5). Several workers (6 & 7) have studied ageing effect in rice. However, there are contradictory report regarding R.H. and temperature effect with respect to deterioration of seeds under accelerated ageing conditions. Thus, there is need to understand the basis of genotypic variability in terms of rice longevity. Keeping in view, ageing treatments were attempted to observe the effect of accelerated ageing on seed germination and vigour in rice in the present study.

MATERIALS AND METHODS

The experiments were conducted with ten diverse cultivars of rice viz. Usar 1, Type 3, Mahsuri,

Ashwani, Saket 4, Type 9, Sarju 52, Basmati 370, Prasad and NDR 118. The germination and seed vigour changes in accelerated aged seed of rice was carried out in the Department of Seed Technology during 1999-2000.

The seed of these genotypes were dried to less than 12.0 per cent moisture content. These seeds were subjected to accelerated ageing by incubating seeds at $40 \pm 1^\circ$ C temperature and 98 ± 2 per cent relative humidity as per method [5] for 3, 5, 7, 9, 12, 15 and 20 days and used for further studies along with unaged seed as control. The germination for all the treatment combinations (10 varieties x 7 ageing periods) along with control were conducted in laboratory as per the ISTA [8]. The seedlings were evaluated on 14th day for germination. For seedling length, ten normal seedling were taken from each replication randomly on 14th day and seedling length were measured in cm. The mean values per replication were calculated. The vigour index (v) was computed by using the formula suggested (2) and expressed in number.

Vigour index = germination percentage x mean seedling length (cm)

For analysis of variance "Statistical procedures for agricultural research" [9] was consulted.

Table 1. Influence of different levels of accelerated ageing on percentage of normal seedlings in rice cultivars

Cultivar	Days to accelerated ageing								Mean Percentage decrease over (0) days	
	0	3	5	7	9	12	15	20		
Usar 1	91.33 (72.88)	88.66 (70.34)	86.33 (68.31)	83.33 (65.91)	80.00 (63.44)	73.66 (59.12)	68.66 (55.97)	48.67 (44.24)	78.72 (62.52)	46.70
Type 3	92.67 (74.40)	87.33 (69.18)	81.33 (64.41)	77.67 (61.82)	74.66 (59.80)	69.67 (56.59)	64.00 (53.14)	41.66 (40.10)	74.92 (59.94)	55.04
Mahsuri	90.05 (71.62)	85.33 (67.52)	82.00 (64.95)	77.33 (61.58)	76.33 (60.93)	71.33 (57.63)	64.00 (53.14)	48.67 (44.24)	75.30 (60.20)	45.95
Ashwani	90.00 (71.57)	85.67 (67.76)	76.66 (61.12)	74.67 (59.78)	71.33 (57.63)	67.33 (55.15)	60.67 (51.16)	44.00 (41.55)	72.35 (58.21)	51.11
Saket 4	93.67 (75.43)	91.66 (73.27)	88.67 (70.38)	84.66 (66.96)	82.33 (65.16)	80.66 (63.92)	76.67 (61.12)	59.33 (50.38)	83.24 (65.83)	36.66
Type 9	89.33 (70.96)	87.33 (69.18)	79.00 (62.73)	72.33 (58.27)	69.33 (56.38)	65.00 (53.74)	61.67 (51.75)	49.00 (44.42)	72.58 (58.43)	45.14
Sarju 52	88.33 (70.03)	84.00 (65.91)	78.00 (62.03)	74.33 (59.56)	73.00 (58.69)	66.67 (54.75)	63.00 (52.54)	48.33 (44.04)	72.60 (58.44)	45.28
Basmati 370	89.67 (71.26)	86.00 (68.06)	82.67 (65.43)	78.00 (62.04)	74.33 (59.57)	68.33 (55.77)	60.00 (50.77)	36.00 (36.86)	73.04 (58.72)	59.85
Prasad	88.33 (70.06)	85.00 (67.22)	77.67 (61.81)	72.00 (58.07)	66.67 (54.75)	60.00 (50.77)	53.33 (46.61)	38.00 (38.05)	68.65 (55.95)	56.97
NDR 118	93.33 (75.07)	91.67 (73.23)	87.66 (69.46)	83.33 (65.93)	80.00 (63.45)	76.67 (61.12)	67.33 (55.15)	54.67 (47.68)	80.57 (63.85)	41.42
Mean	90.78 (72.33)	87.34 (69.16)	82.24 (65.06)	77.94 (61.99)	75.00 (59.98)	70.10 (56.85)	64.05 (53.16)	46.80 (43.17)	75.32 (60.21)	48.44

Arc sine transformed values in parenthesis

	Cultivars	Ageing periods	Interactions
S.E.(m)±	0.24	0.22	0.69
CD(5%)	0.68	0.61	1.94

RESULT AND DISCUSSION

The observations were recorded for germination, seedling length and seed vigour index on ten cultivar subjected to various duration of accelerated ageing. It is evident from table 1 that as the duration of accelerated ageing increased the per cent of germination decreased and after 15 days of ageing there has been sharp decline to the extent of 27 per cent. Among the cultivars Saket 4 upto 12 days, Usar 1 and NDR 118 upto 9 days, Type 3, Mahsuri and Basmati 370 upto 5 days of accelerated ageing could give 80 per cent germination. Comparatively Saket 4, Usar 1, NDR 118, Type 3, Mahsuri and Basmati 370 appeared to be more prone to the adverse conditions. These findings confirms to reports by [7, 10, 11, 12] in rice.

Seedling length was observed and shown in Table 2 also revealed that to be in reducing trend to the increasing duration of accelerated ageing. The cultivars which expressed maximum seedling length of 35.87 cm in Basmati 370 followed by

Type 3(35.55cm), Type 9(34.28 cm) in unaged seed. The seedling length of Type 3, Basmati 370 and Usar 1 has been comparatively higher up to 12 days of ageing but in other cultivars seedling length decreased as faster rate as the duration of ageing period enhanced. Thus these results focuses that cultivar Type 3, Basmati 370, Usar 1 are amenable to long term storage. These results also supported by the findings of [7, 11, 13] in rice.

Seed vigour index were recorded highly significant variable as varietal as well as duration of ageing. The performance for seed vigour index in table 3 indicates the gradual decrease in seed vigour index upto 15 days of accelerated ageing and thereafter there has been abrupt fall.

Among the cultivars excellent seed vigour index was recorded in T3, Basmati 370, Saket 4, NDR 118, Usar 1 and T 9 in un-aged seed. Under aged condition decline in seed vigour index in Saket 4, Usar 1, NDR 118 and T3 due to ageing has been comparatively lower but decline in seed vigour index

Table 2. Influence of different levels of accelerated ageing on seedling length (cm) in rice cultivars

Cultivar	Days to accelerated ageing								Mean	Per cent decrease over (0) days
	0	3	5	7	9	12	15	20		
Usar 1	33.57	32.56	31.33	30.11	28.39	26.54	24.00	21.39	28.49	36.28
Type 3	35.55	34.65	33.48	32.30	30.47	28.35	26.36	23.41	30.55	34.14
Mahsuri	28.28	27.28	26.50	25.40	24.26	23.16	21.37	19.87	24.52	29.73
Ashvani	29.68	28.66	27.30	25.81	24.70	22.68	21.08	19.14	24.88	35.51
Saket 4	33.39	32.42	30.25	28.35	26.80	25.95	24.34	21.66	27.89	35.13
Type 9	34.28	31.60	29.89	27.97	25.98	24.43	22.93	20.30	27.17	40.78
Sarju 52	29.02	27.49	26.02	24.99	23.32	22.20	20.63	19.01	24.08	34.49
Basmati 370	35.87	34.24	32.63	29.95	28.06	26.45	24.63	22.59	29.26	37.02
Prasad	27.00	25.38	23.55	22.03	20.45	19.00	17.85	16.24	21.44	39.85
NDR 118	32.94	31.62	29.42	27.53	25.28	22.94	21.76	19.95	26.39	39.43
Mean	31.96	30.57	29.04	27.41	25.77	24.17	22.50	20.35	26.47	36.40

	Cultivars	Ageing periods	Interactions
S.E.(m)±	0.09	0.09	0.27
C.D. (5%)	0.27	0.24	0.76

Table 3. Influence of different levels of accelerated ageing on seed vigour index in rice cultivars

Cultivar	Days to accelerated ageing								Mean	Per cent decrease over (0) days
	0	3	5	7	9	12	15	20		
Usar 1	3066.37	2886.95	2704.85	2508.88	2270.97	1955.17	1645.03	1040.91	2259.89	66.05
Type 3	3294.05	3026.08	2733.78	2510.10	2274.83	1977.40	1686.75	998.28	2312.66	69.69
Masuri	2545.43	2328.20	2173.00	1972.66	1852.08	1652.33	1366.98	966.83	1857.19	62.01
Ashwani	2671.20	2454.94	2093.07	1927.35	1761.90	1527.09	1272.05	842.16	1818.72	68.47
Saket 4	3127.54	2971.62	2681.84	2400.86	2206.48	2093.32	1866.05	1285.15	2329.11	58.90
Type 9	3062.08	2759.72	2361.29	2022.90	1801.50	1587.73	1414.23	994.72	2000.52	67.51
Sarju 52	2563.44	2309.45	2029.35	1857.61	1702.59	1479.72	1299.67	918.78	1770.08	64.15
Basmati 370	3216.34	2944.41	2697.53	2312.03	2085.75	1807.35	1478.02	812.98	2169.30	74.72
Prasad	2385.29	2157.58	1829.07	1586.52	1363.51	1139.98	946.84	617.17	1503.25	74.12
NDR 118	3074.74	2898.80	2579.47	2294.33	2022.22	1758.20	1465.42	1071.44	2145.58	65.15
Mean	2900.65	2673.77	2388.33	2139.32	1934.18	1697.83	1444.10	954.84	2016.63	67.08

	Cultivars	Ageing periods	Interactions
S.E. (m)±	9.09	8.13	25.73
C.D. (5%)	25.41	22.72	71.87

in Basmati 370 and Prasad has been at higher rate. These results focuses that prevalence of good seed vigour index of Usar 1, T 3, Saket 4 and NDR 118 under advance ageing conditions appears to be desirable for long term storage. These findings also find support from Uttam [11] and Reddy et al [13].

Thus, it is evident from the results of germination, seedling length and seed vigour index that Saket 4, NDR 118 and Usar 1 were found to be superior over other cultivars under accelerated ageing conditions and can withstand adverse storage conditions.

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