Effect of seed treatments and storage containers on seed quality parameters of popular rice (*Oryza sativa* L.) cultivar

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Abstract

Rice cv. RNR 15048 (Telangana sona) was treated with three fungicides viz., thiram @ 0.3 %, carbendazim @ 0.2 % and mancozeb @ 0.25 % and three biocontrol agents viz., *T. harzianum*, *T. viride* and *P. fluorescence* and stored in gunny bag and polythene bag was assessed for seed quality parameters viz., seed germination and seedling vigour at bi-monthly intervals. Seeds treated with thiram (T₁) enhanced seed germination and vigour as compared with untreated seeds (control) in polythene bag and gunny bag storage. Seeds treated with thiram and stored in polythene bag increased seed germination (89.5%) and seedling vigour (SVI-I, 1696) (SVI-II, 1039) at the end of eight months storage period as against the seeds stored in gunny bag which recorded less seed germination (87.2%) and seedling vigour (SVI-I, 1650) (SVI-II, 924) respectively. The other seed treatments viz., carbendazim, *P. fluorescence*, *T. harzianum* and *T. viride* were also found effective in increasing germination and seedling vigour as compared with untreated seeds in polythene bag storage.

Keywords: Seed treatment, seed germination, polythene bag, gunny bag, RNR 15048.

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Introduction

Rice is the main staple food for more than half of the world's population. Seeds lose their viability and vigour due to changes in environmental conditions like temperature and humidity (Roberts, 1972), storing of paddy seeds in polythene bag maintained viability and vigour. Seed treatment is an efficient technology replacing wasteful foliar and soil application of chemicals. In recent years, use of *Trichoderma* spp. as a bioagent was found effective in controlling diseases (Cook and Baker, 1983). Seed treatment should be done as a routine practice as it is a cheap insurance against

possible disasters at a later stage. Thrimurthy (1986) has reported the efficacy of carbendazim (Bavistin) in reducing disease severity.

Materials and Methods

Rice cv. RNR 15048 (fine grain rice variety) was inoculated with *Drechslera oryzae* @ 10⁹ conidia/ml and shade dried for 24 h. The seeds were treated with fungicides and biocontrol agents as dry seed treatment along with untreated (control). After seed treatment the seeds were equally divided into two parts and filled in two containers viz., gunny bag (25 × 15 cm) and polythene bag (10 × 12cm) commercially available 700 gauge. The seeds

thus packed were stored under ambient laboratory conditions of Indian Institute of Rice Research, Rajendranagar, Hyderabad for a period of eight months from August 2015 to April 2016. The laboratory experiments were conducted in four replications adopting Factorial experiment laid out in CRD taking seed treatment as one factor and container as another

Germination (%): The germination per cent was assessed by adopting rolled paper towel method as prescribed by International Seed Testing Association Rules (ISTA, 1996). Germination paper towels of standard size (440 × 330) were dipped in sterile distilled water and drained. Hundred seeds of each rice seed sample were distributed at equidistance. Another towel, similarly was laid over and labelled. The towels were then rolled, drained of excess water, placed in aerated polythene bag and incubated in an upright position at $28 \pm 2^\circ\text{C}$ in a BOD incubator. Four hundred seeds with hundred seeds of each replication were examined. On fourteenth day, germination percentage was recorded.

$$\text{Germination (\%)} = \frac{\text{Number of normal seedlings}}{\text{Total number of seeds}} \times 100$$

Seedling vigour index: Ten normal seedlings from each replication of germination test were taken separately for measuring seedling length in centimeters (cm). The seedling length comprises of root length and shoot length. The same seedlings which were taken for measuring seedling length were oven dried in an hot air oven at 60°C for 24 h for obtaining seedling dry weight and expressed in milligrams (mg). Seedling vigour index I and II were calculated by using the formula given by Abdul Baki and Anderson (1973).

SVI I = Seedling length (cm) × Germination percentage (%)

SVI II = Seedling dry weight (mg) × Germination percentage (%)

factor (Table 1). At bi-monthly intervals, seed samples were drawn from different seed treatments and containers and tested for seed health parameters. The data pertaining to percentage values were analyzed after converting them into transformed values (Gomez and Gomez, 1984).

Results and Discussion

Effect of seed treatments and storage containers on germination and seedling vigour of rice cv. RNR15048: Results of Table 2 indicates that irrespective of the seed treatments and containers, the germination percentage was gradually decreased with increase in period of storage. The per cent germination was above Minimum Seed Certification Standards (80 %) at six months storage period. However, the interaction between seed treatments and storage containers were found non-significant at eight months period of storage. Seeds stored in polythene bag (700 gauge) was recorded higher seed germination than gunny bag during all the periods of seed storage. The decline in seed germination over initial storage period was high in gunny bag (13.2 %) as compared to polythene bag storage (11.7 %). Seed treatments gave significant impact by improving the seed germination over untreated control. Among the seed treatments, thiram (T_1) (88.3 %) followed by carbendazim (T_2) (87.8 %) recorded higher seed germination over other seed treatments during all the storage periods. Treated seed stored in polythene bag was found effective in maintaining the germination over untreated seeds stored in gunny bag. Untreated seed stored in gunny bag showed minimum germination (77.7 %). Seeds treated with *P. fluorescence* (86.1 %), mancozeb (T_3) (84.2 %), *T. viride* (T_4) (81.2 %) and *T. harzianum* (T_6) (79.0 %) recorded higher seed germination over untreated control (T_7) (78.2 %). The results are in agreement with the reports of Imolehin (1983)

and, Zulkifi *et al.*, (1991) who reported reduction in seed germination due to *D. oryzae*. The results of the present study also indicated that seed treatment with thiram provided greater protection to rice seeds and improved viability which is in agreement with Yogalakshmi *et al.*, (1996).

Seedling vigour index was decreased gradually with the period of seed storage in all the seed treatments and storage containers (**Table 3 & 4**). Seeds stored in polythene bag showed higher seedling vigour index than gunny bag in all the seed treatments especially in thiram (T₁) during all the storage periods irrespective of the containers. Irrespective of the seed treatments, seeds stored in polythene bag had significantly higher seedling vigour index over gunny bag. At the end of eight months

period of seed storage, seeds treated with thiram and stored in polythene bag recorded maximum SVI – I & II (1039, 981), while the untreated seeds stored in gunny bag had minimum SVI – I & II (1118, 702). Germination percentage, seedling vigour and storability were found high in thiram (T₁) followed by carbendazim (T₂), *P. fluorescence* (T₅), mancozeb (T₃), *T. viride* (T₄) and *T. harzianum* (T₆) as compared to untreated rice seeds. The decrease in seed vigour index might be attributed to age induced decline in germination, decrease in root and shoot length. The enhancement in germination and seed vigour observed in fungicide treated seeds are in agreement with the results of the studies undertaken by Misra and Dharamvir (1991) and Sachan and Agarwal (1994).

Table 1: Details of seed treatments and storage containers adopted in the experiment

Factor 1: seed treatments	Factor 2: storage container
T1 : Thiram @ 3g/kg	C1 : Gunny bag
T2 : Carbendazim @ 2g/kg	C2 : Polythene bag
T3 : Mancozeb @ 2.5g/kg	
T4 : <i>T. viride</i> @ 10g/kg	
T5 : <i>P. fluorescence</i> @ 10g/kg	
T6 : <i>T. harzianum</i> @ 2.5g/kg	
T7 : Untreated seeds (control)	

Table 2: Effect of seed treatments and storage containers on germination (%) of rice cv. RNR 15048

Treatment	Before storage	2MAS			4MAS			6MAS			8MAS		
		C ₁	C ₂	Mean	C ₁	C ₂	Mean	C ₁	C ₂	Mean	C ₁	C ₂	Mean
T ₁	98.2 (82.6)*	93.7 (75.5)	95.2 (77.4)	94.5 (76.2)	92.5 (74.1)	93.5 (75.2)	93.0 (74.6)	89.7 (71.3)	91.5 (73.0)	90.6 (72.1)	87.2 (69.0)	89.5 (71.0)	88.3 (70.0)
T ₂	98.2 (82.6)	93.0 (74.6)	93.5 (75.2)	93.2 (74.9)	91.2 (72.8)	91.7 (73.3)	91.5 (73.0)	89.5 (71.0)	89.7 (71.3)	89.6 (71.2)	87.0 (68.8)	88.7 (70.4)	87.8 (69.6)
T ₃	95.7 (78.1)	90.0 (71.5)	90.7 (72.3)	90.6 (72.2)	87.7 (69.5)	90.2 (71.8)	89.0 (70.6)	84.7 (67.0)	87.2 (69.1)	86.0 (68.0)	83.2 (65.8)	85.2 (67.4)	84.2 (66.6)
T ₄	95.2 (77.4)	90.7 (72.3)	90.5 (72.0)	90.3 (71.9)	85.0 (67.2)	89.2 (70.8)	87.1 (69.0)	83.5 (66.0)	86.7 (68.6)	85.1 (67.3)	80.0 (63.4)	82.5 (65.2)	81.2 (64.3)
T ₅	96.0 (78.5)	92.5 (74.1)	92.7 (74.4)	92.6 (74.2)	91.2 (72.8)	90.5 (72.0)	90.8 (72.4)	88.7 (70.4)	89.2 (70.8)	89.0 (70.6)	86.0 (68.0)	86.2 (68.2)	86.1 (68.1)
T ₆	95.0 (77.1)	88.2 (69.9)	91.7 (73.3)	90.0 (71.6)	85.5 (67.6)	87.0 (68.8)	86.2 (68.2)	81.2 (64.3)	80.5 (63.7)	80.8 (64.0)	78.7 (62.5)	79.2 (62.9)	79.0 (62.7)
T ₇	95.0 (77.1)	89.2 (70.8)	90.7 (72.3)	90.0 (71.6)	84.0 (66.4)	88.0 (69.7)	86.0 (68.0)	80.7 (63.9)	80.0 (63.4)	80.3 (63.7)	77.7 (61.8)	78.7 (62.5)	78.2 (62.2)
Mean	96.0 (78.0)	91.0 (72.7)	92.1 (73.8)		88.1 (70.0)	90.0 (71.7)		85.4 (67.7)	86.4 (68.6)		82.8 (65.6)	84.3 (66.8)	

	2MAS			4MAS			6MAS			8MAS		
	T	C	T×C	T	C	T×C	T	C	T×C	T	C	T×C
SEm±	0.39	0.21	0.56	0.34	0.18	0.49	0.33	0.17	0.46	0.34	0.18	0.49
CD at 5 %	1.14	0.61	1.61	0.99	0.52	1.40	0.94	0.50	1.33	0.99	0.53	NS

Each value is a mean of four replications

C₁- Gunny bag

C₂- Polythene bag

T₁- Thiram @ 3g/kg

T₂- Carbendazim @ 2g/kg

T₃- Mancozeb @ 2.5g/kg

T₄- *Trichoderma viride* @ 10g/kg

T₅- *Pseudomonas fluorescense* @ 10g/kg

T₆- *Trichoderma harzianum* @ 10g/kg

T₇- Untreated seeds

MAS: months after storage

Table 3: Effect of seed treatments and storage containers on seedling vigour index – I of rice cv. RNR 15048

Treat ment	Before storage	2MAS			4MAS			6MAS			8MAS		
		C ₁	C ₂	Mean	C ₁	C ₂	Mean	C ₁	C ₂	Mean	C ₁	C ₂	Mean
T ₁	2500	2172	2370	2271	1931	2240	2085	1759	1773	1766	1650	1696	1673
T ₂	2474	1920	2320	2120	1820	2213	2016	1536	1890	1713	1400	1782	1591
T ₃	2379	2144	1995	2069	1816	2089	1952	1352	1778	1565	1253	1674	1463
T ₄	2352	1762	2153	1957	1623	2082	1853	1357	1542	1450	1250	1329	1289
T ₅	2420	1995	2222	2108	1765	2163	1964	1480	1776	1628	1448	1563	1505
T ₆	2296	1838	2054	1946	1597	1894	1745	1299	1492	1396	1192	1324	1258
T ₇	2230	1704	2139	1921	1535	1993	1764	1278	1492	1385	1118	1188	1153
Mean	2379	2567	2179		1727	2096		1438	1678		1330	2092	
		2MAS			4MAS			6MAS			8MAS		
		T	C	T×C	T	C	T×C	T	C	T×C	T	C	T×C
SEm±		25.9	13.8	36.7	30.9	16.5	43.7	27.1	14.4	38.3	18.1	9.70	25.6
CD at 5 %		74.16	39.64	104.88	88.31	47.20	NS	77.36	41.35	109.40	51.80	27.69	73.26

Each value is a mean of four replications

Table 4: Effect of seed treatments and storage containers on seedling vigour index – II of rice cv. RNR 15048

Treat ment	Before storage	2MAS			4MAS			6MAS			8MAS		
		C ₁	C ₂	Mean	C ₁	C ₂	Mean	C ₁	C ₂	Mean	C ₁	C ₂	Mean
T ₁	2029	1843	1864	1853	1639	1721	1680	1221	1439	1330	924	1039	981
T ₂	1920	1666	1721	1693	1499	1676	1588	1091	1283	1187	840	1032	936
T ₃	1861	1576	1643	1609	1508	1511	1509	1026	1205	1116	763	867	815
T ₄	1801	1557	1660	1608	1394	1490	1442	1045	1183	1114	798	814	806
T ₅	1920	1583	1794	1689	1466	1598	1532	1080	1246	1163	887	827	857
T ₆	1750	1506	1611	1558	1352	1462	1407	992	1117	1054	702	702	702
T ₇	1684	1438	1524	1481	1229	1377	1303	890	931	911	766	613	690
Mean	1852	1595	1688		1441	1548		1049	1201		811	842	
		2MAS			4MAS			6MAS			8MAS		
		T	C	T×C	T	C	T×C	T	C	T×C	T	C	T×C
SEm±		23.7	12.6	33.5	20.0	10.7	28.3	19.0	10.1	26.9	38.6	20.6	54.6
CD at 5 %		67.7	36.2	NS	57.2	30.5	NS	54.4	29.0	NS	110.2	NS	NS

Each value is a mean of four replications

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