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Anuradha Parmar
Research Scholar, Faculty of Agriculture Science and Technology, Mansarovar Global University, Sehore Bilkishganj, Bhopal, Madhya Pradesh, India

SN Mishra
Assistant Professors, Faculty of Agriculture Science and Technology, Mansarovar Global University, Sehore Bilkishganj, Bhopal, Madhya Pradesh, India

Devesh K Pandey
Associate Professor, Faculty of Agriculture Science and Technology, Mansarovar Global University, Sehore Bilkishganj, Bhopal, Madhya Pradesh, India

Corresponding Author:
Anuradha Parmar
Research Scholar, Faculty of Agriculture Science and Technology, Mansarovar Global University, Sehore Bilkishganj, Bhopal, Madhya Pradesh, India

Influence of seed treatment on seed quality and storability in different genotypes wheat (*Triticum aestivum* (L.) seeds

Anuradha Parmar, SN Mishra and Devesh K Pandey

Abstract
Investigate the impact of fungicides and insecticides on wheat seed quality characteristics and storability, a storage experiment was carried out. Different genotypes of carryover wheat seeds from the rabi season were the experimental material. For a period of 18 months of storage, observations were months on the following parameters: germination (%), seedling length (cm), dry weight (g), vigour index-I and vigour-II, speed of germination, field emergence (%). As the storage duration lengthened, all parameters decreased. According to the findings, the treated seeds recorded germination %, seedling length, seedling dry weight, vigour index I and II, speed of germination, and field emergence was comparable to the untreated control group (T_1). We can therefore draw the conclusion that wheat seed can be handled in one of two ways to retain seed quality and improve storability. According to the findings, the genotype V1 (DBW 110) had better quality metrics than other genotypes even after 18 months of storage. It was discovered that polythene bags (700 gauges) were a superior packaging material for maintaining the seed quality of wheat seeds. Wheat seeds treated with 12% carbendazim and neem oil maintained their seed quality better during extended periods of storage. The interaction effect of carbendazim-treated seeds packed in vapor-proof polythene bags (700 gauge) and kept at room temperature has been shown to be more effective at preserving wheat seed quality for longer periods of storage.

Keywords: Seed treatment, seed quality, storability, genotypes wheat, *Triticum aestivum* (L.)

Introduction
Wheat, (*Triticum aestivum* L.) the world's largest cereal crop which belongs to Poaceae family of the genus Triticum. It has been described as the 'King of cereals' because of the acreage it occupies, high productivity and the prominent position in the international food grain trade. Wheat is consumed in a variety of ways such as bread chapatti, porridge, flour, suji etc. The term "Wheat" is derived from many different locations, specifically from English, German and Welsh language. Wheat is most commonly defined by all cultures as "that which is white" due to its physical characteristics of light colored crops. The primary input in agriculture, quality seed, is crucial to achieving maximum yield and productivity of any crop. High-quality and vigorous seed will not only aid in obtaining the ideal plant population in the field but will also produce a thriving seedling that can significantly outperform the early abiotic and biotic challenges (Jacob *et al.*, 2016) [13]. The natural process of seed deterioration during storage includes a variety of changes at different levels, including reduction or shifts in metabolic activity, compositional alterations, declines or changes in enzyme activities, phenotypic and cytological changes, as well as quantitative losses. Given their hygroscopic nature, seeds' viability and vigour while being stored are known to be influenced by changes in physio-chemical variables, seed quality at planting, storage structures, and packaging materials (Doijode, 2000) [4]. Seeds can be stored in controlled environments or given various chemical treatments to slow down the rate of seed degeneration. The greatest alternative strategy to maintain seed quality is seed treatment because regulated conditions are extremely expensive. Through research advancements over the last several decades, seed treatment technology has advanced and produced a number of items that can be utilised to control the performance potential of the seeds and following crop (Jacob *et al*., 2016) [13]. The delivery of nutrients (Farooq *et al*., 2012) [6], growth hormones (Gevrek *et al*., 2012) [9], pesticides (Sherry *et al*., 2007) [32], biocontrol agents (Sherry *et al*., 2012) [32], synchronisation of flowering between parental lines (Johnson *et al*., 1999) [14], precision sowing (Lagoa *et al*., 2012) [18], seed quality enhancement (Kumar *et al*., 2007) [32] (Guan *et al*., 2013) [11]. As a result, there is growing in various aspects of this technology as its application can be expanded to different crops that are

grown and stored under different agro-climatic conditions. This is because the seed treatment concept is now becoming a practical reality for various applications. Among these ideas, polymer film coating has been shown to improve crop establishment, especially under challenging circumstances.

Materials and Methods

The current study was conducted at Research Laboratory of the Faculty of Agriculture Science & Technology, Mansarovar Global University, and Bilkisganj Sehore M.P. Experimental material consisted of carry over wheat seed The experiment was conducted under a completely randomized design (FCRD) and each treatment 24 sublets of seed samples were prepared before the seeds were put through a germination and vigour test. Factor 1: Genotypes

(V) V1: DBW-110 V2: MP-4106, V3: MP-3288, Factor II: Packaging material (C) C1: Polythene bag (700 gauge) C2: Jute bag, Factor III: Seed treatment (T) T0: Control T_1: Neem Oil (10 ml/kg) T_2: Turmeric powder (20 g/kg) T_3: Carbendazim 12% (2.5 g /kg). The essential amounts of seeds were treated with varying concentrations of Neem Oil, Turmeric powder, and Carbendazim 12% before being packed in polythene bags and jute bags, respectively. The seeds were dried after being treated with neem oil (10 ml/kg), turmeric (20 g/kg), and carbendazim (12%) to bring the moisture content down to 9% for storing in polythene bags. After drying, the seeds were packaged in jute bag (C2) and standard polythene bag (C1) (700 gauge) and kept at room temperature for 18 months.

Results and Discussion

Under the conditions of a laboratory experiment, the responses of Wheat seed to various seed treatments were interpreted in terms of germination percentage, shoots length (cm), root length (cm), seedling length (cm), seedling dry weight (g), vigour index, seed viability, electrical conductivity, seed health, and field emergence. The collected data were statistically examined to determine the importance of variation resulting from various seed treatments and packaging materials. The preponderance of seed quality attributes deteriorated as storage time increased. The final count's mean germination % at the starting and completion of storage December 2020 to June 2022.

The experiment consisted of three genotypes *viz.*, (V1) DBW110, (V2) MP 4106 and (V3) MP 3288 as first factor and three treatments *viz.*, Neem oil (T_1), Turmeric Powder (T_2) and Carbendazim 12% (T_3) with the untreated control (T0) as second factor and seed samples were packed in polythene bags (C1), and jute bags (C2) as third factor and stored for 18 months. The seed quality parameters like germination percentage, root length, shoot length, seedling length, seedling dry weight, seedling vigour index, seed viability, field emergence, electrical conductivity of seed leach ate and seed health test were determined.

Among the genotypes, the (V1) DBW110 recorded higher germination percentage (66.03%), The similar decreasing tends in seed germination (%) with the progress in storage period have been recorded by Larissa *et al*. (2004) [19], Baig and Biradar (2005) [2], Khatun *et al.* (2015) [15]. root length (8.51 cm), shoot length (5.69 cm), seedling length (14.21cm), The similar decreasing tends in shoot length (cm) with the progress in storage period have been recorded by Khatun *et al.* (2015) [15], Larissa *et al*. (2004) [19], Baig and Biradar (2005) [2]. seedling dry weight (0.0128 gm), seed quality parameters i.e. fresh weight (g) and seedling dry weight with the progress in storage period were reported by Larissa *et al*. (2004) [19], Baig and Biradar (2005) [2], Khatun *et al.* (2015) [15]. seedling vigour index (953.89), the progress in storage period have been reported by Larissa *et al*. (2004) [19], Baig and Biradar (2005) [2], Khatun *et al.* (2015) [15]. seed viability (67.69%), field emergence (59.91%). More or less similar findings were observed by Patil *et al*. (2001) [23], Celine *et al.* (2002) [3], Shukla *et al.* (2006) [33], Gimplinger *et al.* (2007) [10] and Priya *et al.* (2007) [24]. under ambient condition throughout the storage period of 18 months, V1 also maintained the germination above minimum seed certification standards even at the end of 18 months of storage period.

Among the seed treatments carbendazim 12% (T_3) followed by neem oil (T_1), recorded higher seed quality parameters throughout the storage period in all the genotypes. Seeds treated with carbendazim recorded higher germination compared to neem oil and control.

Among the packing materials seeds packed in polythene bag recorded higher germination, followed by jute bags and other quality parameters were also higher in comparison to those seeds stored in jute bags throughout the storage period in all Wheat genotypes. The vapor proof container maintained germination above minimum seed certification standard up to 18 months of storage compared to jute bags.

In the interaction effect of genotypes, seed treatment and packing material, seeds treated with carbendazim 12% were found to be compatible with packing in vapor proof container polythene bag (700 gauge) and preserved in ambient storage recorded higher for germination which was above the minimum seed certification standard even after 18 months of storage period and also higher values for other quality parameters when compared to other treatment combinations throughout the storage period.

On the basis of the results obtained from two years field trial on performance of wheat genotypes, it is clear that the different genotypes, procured from various parameters showed good performance The control was mostly found infected by fungi during storage and the treatment combination with neem oil traces of fungi. Carbendezim combination with genotypes fungal infection during the storage period. So, it can be used as combination with the genotypes to maintain seed health during storage.

Overall average performance of fungicides, biocides and packaging materials on Seed quality of different genotypes of Wheat seeds at different periods of storage.

Table 1: Mean performance of different genotypes, fungicides, biocides, and packaging materials on germination% and Root length (cm) of Wheat at different periods of storage

Treatments	Combination	Germination (%)						Root length (cm.)					
		3 month	6 month	9 month	12 month	15 month	18 month	3 months	6 months	9 months	12 months	15 months	18 months
T_1	V1 T0 C1	90.25	88.00	83.00	80.50	77.75	61.25	18.15	16.95	15.08	13.68	10.78	8.28
T_2	V2 T0 C1	90.25	88.00	82.25	79.75	77.00	56.50	18.25	16.93	14.80	13.40	10.50	8.00
T_3	V3 T0 C1	90.00	86.75	82.25	79.50	76.75	55.75	18.28	16.95	14.05	12.65	9.75	7.25
T_4	V1 T0 C2	90.25	86.75	81.00	77.75	71.50	53.50	18.25	16.60	14.80	12.80	8.80	5.95
T_5	V2 T0 C2	90.25	85.75	81.50	77.50	69.25	51.25	18.63	16.38	14.80	12.35	8.75	5.83
T_6	V3 T0 C2	90.00	85.50	80.50	75.75	69.00	50.25	18.40	16.30	14.55	12.45	8.53	5.40
T_7	V1 T1 C1	92.75	91.25	89.00	88.00	83.50	71.25	19.53	18.25	15.80	14.55	12.50	10.00
T_8	V2 T1 C1	91.25	90.25	88.00	88.00	83.00	68.50	19.75	18.08	15.30	13.90	11.50	9.13
T_9	V3 T1 C1	90.25	89.75	86.75	87.00	82.25	67.25	19.05	17.85	14.88	13.48	11.08	8.58
T_{10}	V1 T1 C2	91.00	90.00	88.00	87.00	81.50	64.50	18.30	17.10	15.53	14.18	10.03	7.53
T_{11}	V2 T1 C2	90.00	89.00	87.00	86.00	80.75	62.00	18.50	17.30	16.13	13.95	9.90	7.40
T_{12}	V3 T1 C2	90.00	89.00	87.00	86.00	78.75	59.25	17.80	16.60	15.38	13.98	9.90	7.40
T_{13}	V1 T2 C1	92.50	91.25	89.50	86.75	81.25	68.75	18.08	17.28	16.65	14.83	11.98	9.48
T_{14}	V2 T2 C1	91.50	90.00	89.00	85.50	81.00	67.75	19.50	18.30	15.45	13.58	11.18	8.68
T_{15}	V3 T2 C1	90.50	90.00	89.00	84.25	80.75	65.75	18.05	17.35	14.70	13.30	10.90	8.40
T_{16}	V1 T2 C2	91.00	88.25	87.75	85.75	79.50	63.75	19.20	18.00	15.80	13.45	9.38	6.88
T_{17}	V2 T2 C2	90.00	87.00	86.00	84.25	79.00	62.50	18.60	17.40	15.53	13.63	9.15	6.65
T_{18}	V3 T2 C2	90.00	87.25	85.00	83.50	77.75	57.75	17.87	16.68	14.80	12.70	9.35	6.85
T_{19}	V1 T3 C1	92.25	93.50	90.50	89.00	85.00	76.75	19.43	18.40	17.60	16.20	13.85	11.30
T_{20}	V2 T3 C1	92.25	91.00	89.25	88.25	83.50	72.00	19.05	17.85	15.88	14.48	12.08	9.58
T_{21}	V3 T3 C1	92.25	90.50	88.00	87.50	83.25	70.25	19.25	18.05	15.05	13.65	11.25	9.05
T_{22}	V1 T3 C2	92.25	90.50	87.50	87.00	83.25	68.50	18.50	17.30	17.80	14.85	11.55	8.70
T_{23}	V2 T3 C2	91.50	90.00	87.00	86.75	83.00	69.50	18.63	17.20	15.05	13.65	10.85	8.35
T_{24}	V3 T3 C2	91.25	90.00	87.00	86.25	82.25	67.00	18.50	17.30	14.80	13.40	10.60	8.10
	Grand M	90.98	89.14	86.32	84.48	79.60	63.81	18.65	17.35	15.42	13.71	10.59	8.03
	SE+-	1.05	1.15	1.15	1.35	1.20	1.65	0.90	0.90	0.90	0.70	0.76	0.61
	CV	1.16	1.29	1.33	1.60	1.51	2.58	4.82	5.18	5.82	5.10	7.17	7.61
	Range Max	92.75	93.50	90.50	89.00	85.00	76.75	19.75	18.40	17.80	16.20	13.85	11.30
	Range Min	90	85.5	80.5	75.75	69	50.25	17.8	16.3	14.05	12.35	8.525	5.4

Table 2: Mean performance of different genotypes, fungicides, biocides, and packaging materials on shoot length (cm.) and Seedling length (cm.) of Wheat at different periods of storage.

Treatments	Combination	shoot length (cm.)						Seedling length (cm.)					
		3 month	6 months	9 months	12 months	15 months	18 months	3 months	6 months	9 months	12 months	15 months	18 months
T_1	V1 T0 C1	12.50	11.60	8.65	7.63	6.83	5.73	30.65	28.55	23.73	21.30	17.60	14.00
T_2	V2 T0 C1	11.50	10.53	7.70	6.68	5.88	4.78	29.75	27.45	22.50	20.08	16.38	12.78
T_3	V3 T0 C1	12.13	11.03	7.68	6.95	6.15	5.05	30.40	27.98	21.73	19.60	15.90	12.30
T_4	V1 T0 C2	11.25	10.15	6.98	5.85	5.05	3.95	29.50	26.75	21.78	18.65	13.85	9.90
T_5	V2 T0 C2	12.25	10.30	7.10	6.05	5.25	4.15	30.88	26.68	21.90	18.40	14.00	9.98
T_6	V3 T0 C2	10.75	9.90	6.58	5.55	4.75	3.65	29.15	26.20	21.13	18.00	13.28	9.05
T_7	V1 T1 C1	13.38	12.18	9.92	8.89	7.67	6.49	32.90	30.43	25.72	23.44	20.17	16.49
T_8	V2 T1 C1	13.05	12.25	9.89	8.84	7.59	6.28	32.80	30.33	25.19	22.74	19.09	15.40
T_9	V3 T1 C1	11.75	10.95	8.60	7.60	6.85	6.05	30.80	28.80	23.48	21.08	17.93	14.63
T_{10}	V1 T1 C2	12.63	11.80	8.63	7.63	6.83	5.73	30.93	28.90	24.15	21.80	16.85	13.25
T_{11}	V2 T1 C2	12.00	10.90	8.45	7.48	6.68	5.58	30.50	28.20	24.58	21.43	16.58	12.98
T_{12}	V3 T1 C2	11.50	10.65	8.01	7.04	6.24	5.14	29.30	27.25	23.39	21.01	16.14	12.54
T_{13}	V1 T2 C1	12.25	11.45	8.60	7.55	6.75	5.65	30.33	28.73	25.25	22.38	18.73	15.13
T_{14}	V2 T2 C1	12.00	11.20	8.10	7.00	6.20	5.10	31.50	29.50	23.55	20.58	17.38	13.78
T_{15}	V3 T2 C1	11.50	10.70	7.73	6.68	5.88	4.90	29.55	28.05	22.43	19.98	16.78	13.30
T_{16}	V1 T2 C2	12.25	11.45	8.00	6.60	6.03	4.75	31.45	29.45	23.80	20.05	15.40	11.63
T_{17}	V2 T2 C2	11.25	10.45	7.31	6.21	5.41	4.31	29.85	27.85	22.84	19.84	14.56	10.96
T_{18}	V3 T2 C2	10.63	9.83	7.23	6.15	5.35	4.25	28.50	26.50	22.03	18.85	14.70	11.10
T_{19}	V1 T3 C1	12.88	12.15	10.29	9.33	8.53	7.43	32.30	30.55	27.89	25.53	22.38	18.73
T_{20}	V2 T3 C1	12.00	11.53	8.93	8.26	7.41	6.33	31.05	29.38	24.81	22.73	19.48	15.91
T_{21}	V3 T3 C1	11.75	10.95	8.84	7.98	7.18	6.18	31.00	29.00	23.89	21.63	18.43	15.23
T_{22}	V1 T3 C2	12.00	11.20	8.65	7.73	6.93	5.83	30.50	28.50	26.45	22.58	18.48	14.53
T_{23}	V2 T3 C2	11.88	11.08	8.24	7.37	6.57	5.47	30.50	28.28	23.29	21.02	17.42	13.82
T_{24}	V3 T3 C2	11.50	10.90	8.23	7.35	6.55	5.45	30.00	28.20	23.03	20.75	17.15	13.55
	Grand M	11.94	11.05	8.26	7.26	6.44	5.34	30.59	28.39	23.69	20.98	17.03	13.37
	SE+-	0.80	0.78	0.58	0.49	0.50	0.47	1.50	0.90	1.00	0.81	0.90	0.94
	CV	6.66	7.06	7.03	6.74	7.82	8.84	4.90	3.17	4.22	3.88	5.28	7.04
	Range Max	13.38	12.25	10.29	9.33	8.53	7.43	32.90	30.55	27.89	25.53	22.38	18.73
	Range Min	10.625	9.825	6.575	5.55	4.75	3.65	28.5	26.2	21.125	18	13.275	9.05

Table 3: Mean performance of different genotypes, fungicides, biocides, and packaging materials on Seedling Dry weight (gm) and seedling vigour index of Wheat at different periods of storage

Treatments	Combination	Seedling Dry weight (gm)						seedling vigour index					
		3 months	6 months	9 months	12 months	15 months	18 months	3 months	6 months	9 months	12 months	15 months	18 months
T_1	V1 T0 C1	0.0200	0.0180	0.0160	0.0140	0.0130	0.0115	2766.25	2511.90	1969.45	1714.67	1368.82	858.45
T_2	V2 T0 C1	0.0179	0.0159	0.0143	0.0123	0.0113	0.0098	2684.75	2414.77	1850.02	1601.12	1260.52	722.60
T_3	V3 T0 C1	0.0150	0.0161	0.0141	0.0121	0.0111	0.0096	2736.00	2427.6	1787.22	1558.12	1221.37	684.87
T_4	V1 T0 C2	0.0200	0.0180	0.0134	0.0104	0.0089	0.0074	2662.25	2320.6	1762.75	1450.77	990.50	529.82
T_5	V2 T0 C2	0.0163	0.0143	0.0118	0.0088	0.0078	0.0062	2787.12	2287.47	1785.00	1426.30	969.77	511.47
T_6	V3 T0 C2	0.0150	0.0130	0.0106	0.0076	0.0066	0.0051	2623.70	2240.05	1700.67	1363.95	915.77	455.32
T_7	V1 T1 C1	0.0244	0.0239	0.0219	0.0190	0.0188	0.0174	3051.45	2775.10	2289.50	2062.52	1684.05	1174.95
T_8	V2 T1 C1	0.0200	0.0180	0.0174	0.0154	0.0144	0.0129	2997.00	2740.62	2215.36	2000.35	1584.12	1055.27
T_9	V3 T1 C1	0.0188	0.0168	0.0158	0.0143	0.0133	0.0118	2779.50	2585.00	2036.55	1833.27	1474.92	984.55
T_{10}	V1 T1 C2	0.0250	0.0216	0.0176	0.0125	0.0128	0.0113	2814.05	2601.00	2125.50	1896.50	1373.35	853.40
T_{11}	V2 T1 C2	0.0200	0.0186	0.0166	0.0128	0.0119	0.0104	2744.75	2509.25	2136.42	1843.22	1338.60	803.45
T_{12}	V3 T1 C2	0.0165	0.0145	0.0125	0.0105	0.0095	0.0080	2636.62	2425.62	2034.70	1806.63	1270.78	743.47
T_{13}	V1 T2 C1	0.0256	0.0249	0.0226	0.0180	0.0164	0.0149	2808.45	2621.00	2259.80	1942.00	1520.75	1041.95
T_{14}	V2 T2 C1	0.0200	0.0180	0.0160	0.0140	0.0130	0.0115	2881.75	2654.87	2095.95	1760.42	1408.17	932.85
T_{15}	V3 T2 C1	0.0181	0.0161	0.0141	0.0121	0.0111	0.0096	2674.80	2524.82	1995.92	1681.70	1355.90	874.52
T_{16}	V1 T2 C2	0.0238	0.0218	0.0179	0.0150	0.0119	0.0104	2862.00	2599.60	2088.60	1719.20	1224.07	741.17
T_{17}	V2 T2 C2	0.0188	0.0167	0.0148	0.0125	0.0115	0.0099	2686.60	2423.30	1963.60	1671.31	1150.02	684.35
T_{18}	V3 T2 C2	0.0156	0.0136	0.0116	0.0093	0.0083	0.0099	2564.70	2313.32	1872.81	1574.25	1143.30	640.85
T_{19}	V1 T3 C1	0.0270	0.0250	0.0236	0.0216	0.0206	0.0191	3003.95	2856.17	2523.77	2271.27	1901.20	1436.65
T_{20}	V2 T3 C1	0.0273	0.0238	0.0225	0.0205	0.0190	0.0180	2863.85	2673.82	2214.08	2005.00	1626.55	1145.90
T_{21}	V3 T3 C1	0.0184	0.0169	0.0156	0.0136	0.0135	0.0120	2857.50	2624.75	2102.03	1891.90	1533.95	1069.42
T_{22}	V1 T3 C2	0.0188	0.0168	0.0148	0.0128	0.0118	0.0103	2814.00	2579.25	2314.85	1964.02	1538.07	994.75
T_{23}	V2 T3 C2	0.0206	0.0186	0.0166	0.0138	0.0128	0.0113	2789.75	2544.35	2025.78	1822.98	1445.51	962.57
T_{24}	V3 T3 C2	0.0156	0.0136	0.0116	0.0101	0.0099	0.0083	2737.25	2538.00	2003.17	1789.47	1410.45	907.20
	Grand M	0.0199	0.0181	0.0160	0.0134	0.0125	0.0111	2784.50	2533.01	2048.06	1777.13	1362.94	867.07
	SE+-	0.0018	0.0017	0.0015	0.0013	0.0013	0.0011	140.45	104.91	61.09	58.42	77.9136	53.52
	CV	8.8838	9.4785	9.5567	9.9271	10.2624	9.4652	5.04	4.14	2.98	3.28	5.71	6.17
	Range Max	0.0273	0.0250	0.0236	0.0216	0.0206	0.0191	3051.45	2856.17	2523.77	2271.27	1901.20	1436.65
	Range Min	0.0150	0.0130	0.0106	0.0076	0.0066	0.0051	2564.70	2240.05	1700.68	1363.95	915.78	455.33

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Conclusion
From the result, it is concluded that the genotype V1 (DBW 110) showed better quality parameters even after 18 months of storage period than other genotypes. Polythene bag (700 gauges) was proved to be better packaging material in preserving the seed quality of Wheat seeds. Seeds treated with Carbendazim @ 12%, and neem oil proved to be better for maintaining seed quality of Wheat seeds for longer periods of storage. The interaction effect of seeds treated with carbendazim packed in vapor proof container (polythene bag (700 gauge) and stored under ambient conditions is proved to be better in maintaining the seed quality of Wheat for longer periods of storage.
The present study reiterated the importance of proper storage techniques and their impact on seed quality parameters of Wheat seeds. Apart from correct storage, the original condition of the seeds needs to be taken into account before they are stored as insect damage could create the problem. Seed treatments have a major role in protecting the seed during storage and can also play an important role in achieving uniform seedling emergence under certain conditions. This study confirms that germination capacity of the stored grains decreased in all types of seed treatments and packing materials with the process of storage period.

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