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Influence of seed source, containers and seed treatment with chemical and biopesticide on storability of wheat (*Triticum aestivum* L.)

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Abstract
A storage experiment was conducted to understand the effect seed source, containers and seed treatment with chemical and bio pesticide on storability of wheat at Department of Genetics and Plant Breeding, Sam Higginbottom Institute of Agriculture, Technology & Sciences, Allahabad (U.P.) India. Genotypes of wheat were treated with the synthetic polymer and biocide. Then the poly-coated seeds shade dried and further treated with biocide, (i.e. neem oil), polymer coating 29ml/g and bio pesticide (i.e., carbendazim12%+ mencozeb63% WAP 2 2.5 gm / kg) at recommended dosage and stored in types of packaging materials, normal plastic bags (700 gauges) and jute bags. Completely randomized design was used for the experiment, with storage time and seed treatment as factors. Observations shows that the treatments of seed stored in plastic bag for 18 months displayed significant higher percentage of seed viability, germination, seedling length and seed vigour, as compared to other treated seeds were stored in jute bag. Germination and vigour percentage decreased with the period of ageing. Seeds are stored in plastic bags were affected due to storage but the effects were more pronounced in the plastic bags as compared to jute bags.

Keywords: Wheat, Polymer coating, Biocide, Pesticide and Quality Parameters.

1. Introduction
For constant availability of agricultural products used for food, agriculture purposes, and for stabilizing the economy of any country it becomes most important to maintain continuity in supplying quality food grains to consumers as well as to farming community. Wheat with its root ramifying into the depths of human culture has an evolutionary history parallel with history of human civilization itself. Even today, it decides the feast or famine for millions of people. Wheat attained its premier position by virtue of its unique protein gluten, which is responsible of bread making properties of wheat flour. It is highly nutritious cereal foodstuff and its amino acid yield per acre for exceeds that of animal products (Rahraw *et al.* 2013) [6]. Seed are required to be kept in safe storage since they are harvested in the preceding season and usually used for sowing in the subsequent season often after a time gap of six months or longer. Thus proper storage is required to keep seeds in good condition. Some varieties needs air conditioned storage. Storage costs are also added in order to drive cost of seed. Seed is stored form the moment it attains physiological maturity on the plant until it is sown. The weathering agencies like high moisture, oxygen, sunlight, insects and diseases cause adverse effects on the seed before harvest. Improper and delayed harvesting as well as processing cause further injury to the seeds. Seeds are stored under optimal storage conditions (low temperature and low seed moisture content) to prolong the seed viability. Hence, the present study was taken up to seed treatment with botanicals and containers on storability of wheat.

2. Materials and Methods
The seeds of wheat were treated with the synthetic polymer and biocide. Then the poly-coated seeds were shade dried and further treated with biocide, *i.e.* neem oil, polymer coating and carbendazim12%+ mencozeb63% W.A.P. 25% at recommended dosage. It were packed in normal plastic bag (700 gauges) and jute bag (P3), and stored under ambient condition in the Seed Testing Laboratory, Department of Genetics and Plant Breeding, SHIATS, Allahabad for 3,6,12,15, and 18 months. The treatments were set in Complete Randomized design (CRD) in factorial arrangement. For seed viability, seedling characters, the germination test was conducted using four replications of 100 seeds from each sample in rolled towel papers as per procedure described by ISTA (1993). Seed vigour (%) was determined by Baki and Anderson (1973) [1]. Several observations were recorded trimonthaly during storage in order to determine the suitable botanical, treatments and packaging materials for better storage of wheat.

3. Results and Discussion
The seeds were treatments and packaging materials (plastic and jute bags) showed significant superiority on seed quality parameters during storage. The statistically data on seed

viability has influenced by storage conditions, packing material and seed treatments that indicates that earlier reduction in seed viability was observed in genotype V_1 (Dorokhshan-08) after eighteen months of storage whereas it fall down to (71.90%) as compared to (98.84%) at three months of storage period, however, V_2 (PBW-154) found to significantly maximum for seed viability (72.44%) after eighteen months of storage followed by V_3 (Gul-96)(72.12%). The higher seed viability after eighteen months of storage was recorded in seed treatments T_3 (Carbendazim12% + Mancozeb63%) (76.46%) followed by T_2 (polymer coating) (76.00%) after three months of storage the seed treatment with T_3 (Carbendazim12% + Mancozeb63%) (99.20%) was also noticed significantly superior values than other treatments. However, the packaging material, the C_1 (plastic bag) was found to be significantly superior to C_2 (Jute bag) after 18 months storage in securing the seed viability, which were showed statistically significant over jute bag (table 1). The highest reduction in seed germination was depicted in genotype V_1 (Dorokhshan-08) after eighteen months of storage whereas, its fall down to (69.84) percent as compared to (97.03) percent at three months of storage period. In rest of the genotypes the maximum germinability (70.25%) after eighteen months of storage was retained in V_3 (Gul-96) followed by V_2 (PBW-154) (70.03) whereas; after three months of storage the genotype V_1 (Dorokhshan-08) was recorded significantly superior values than other genotypes. The percentage of seed germination after eighteen months of storage as influenced by the polymer, biocides and fungicide seed treatments. The seed treatment T_3 (Carbendazim12% + Mancozeb63%) treatment has been retained maximum germination (74.45 %) as compared to other seed treatment followed by T_2 polymer coating (72.58%), and T_1 neem oil (72.58%) which were statistically significant to over control T_0. Among the packaging material, C_1 (polythene) bag was found to be significantly superior in case of percentage seed germination (74.47%) followed by C2 (jute bag) (65.60%) after eighteen months of storage. However, with the increase in storage period there has been decrease in percent seed germination in all the polymer, biocides and fungicide seed treatment including control (table2).The decline in germination percentage may be attributed to ageing effect leading to depletion of food reserves and decline in synthetic activity of embryo apart from death of seed because fungal invasion, insect damage, fluctuating temperature, relative humidity and storage container in which seeds are stored. The polymer reduced the impact of ageing enzymes; this suggests that polymer protective agent against seed deterioration due to fungal invasion and physiological ageing as result of which the seed viability was maintained for a comparatively longer period of time. These findings are in agreement with results obtained by Rahraw *et al*. 2013 [6] in wheat and Duruigbo (2010) [2] in Maize and Cowpea seeds.

The statistically of data pertaining to (table 3) maximum reduction in seedling length (cm) was recorded in genotype V_1 (Dorokhshan-08) after 18 months of storage where as it fall down to (13.4 cm), as compared to (26.87 cm) at three months of storage period, However, V_2 (PBW-154) was found to significantly maximum for seedling length (14.70 cm) after eighteen months of storage followed by V_3 (Gul-96) (13.92 cm) that indicate to significant to other genotypes. The maximum seedling length after eighteen months of storage was recorded in seed treatment T_3 (Carbendazim12% + Mancozeb63%) (15.6 cm) followed by T_2 (polymer coating) (14.6cm) whereas, after three months of storage the seed treatment with T_2 (polymer coating) (28.3 cm) was noticed superior values than other treatments. With indicated the packaging materials the C_1 (plastic bag) was found to be significantly superior in case of seedling length (15.20 cm) followed by jute bag (12.84 cm) after eighteen months of storage and Polythene bag should be to statistically significant to over jute bag. With reference to the packaging materials the shoot and root length found to be significantly uperior in plastic bags to cloth bag and jute bag. Similar results reported by Saxena *et al*. (1987) in onion seeds and Kumar and Rai (2006 & 2007) [4, 5] in maize.

The statistically of data pertaining to (table 4) maximum reduction in seed vigour was depicted in genotype V_1 (Dorokhshan-08) after eighteen months of storage whereas, it fall down to (55.25%), as compared to (84.00%) at 3 months of storage period, however, V_3 (Gul – 96) was found to be significantly, maximum for seed vigour after eighteen months of storage Gul-96 (56.18%) followed by V_2 (PBW-154) (55.97%.). The maximum seed vigour after 18 months of storage was recorded in seed treatment T_3 (Carbendazim12% + Mancozeb63%) (60.58 %) followed by T_2 (polymer coating) (59.58%) whereas, after 3 months of storage the seed treatment with T_3 (Carbendazine12% + Mancozeb63%) (84.67%) was found significantly superior values than other treatments, which were all treatment shoed statistically significant to over the control after eighteen months of storage. With reference to the packaging materials, the C_1 (plastic bag) was found to be significantly superior to C_2 (Jute bag) after eighteen months of storage in securing the seed vigour % T_4 plastic bag (60.39%) should to be significant to over the jute bag (51.10%) after eighteen months of storage. Significant differences in seed vigour (%) due to seed treatments were observed throughout storage period. The polymer coated or seeds treated with Biocides recorded significantly higher seed vigour (%) compared to untreated seeds. The present study revealed that, with the advance in the storage period, irrespective of containers and seed treatment chemicals and their interactions all the seed quality parameters were gradually decreased. This might be due to ageing phenomenon and due to the depletion of food reserves and decline in synthetic activity (Shakuntala *et al*., 2012) [8]

Table 1: Mean Seed viability of Influence of polymer coating, biocide and packaging materials on storability of wheat seeds.

Factor		Seed Viability %					
Genotypes (G)		3 month	6 month	9 month	12 month	15 month	18 month
V_1	Dorokhshan-08	98.84	96.50	91.56	86.50	78.68	71.90
V_2	PBW-154	98.46	96.87	91.90	85.96	79.15	72.43
V_3	Gul – 96	98.56	96.84	92.06	86.37	79.03	72.12
	F – test	NS	S	S	S	S	S
	S. Ed. (±)	0.38	0.17	0.18	0.19	0.17	0.22
	C.D at 5%	0.76	0.35	0.36	0.39	0.35	0.45

Seed treatments (T)							
T_0	Control	97.41	91.41	85.45	78.12	68.50	61.62
T_1	Neem oil @10 ml/kg	98.95	98.04	93.79	88.87	82.04	74.54
T_2	Polymer Coating 2 9 ml/ kg	98.91	98.79	93.95	88.87	82.66	76.00
T_3	Carbendazim12% + Mancozeb63% W.P 2 2.5 gm / kg	99.20	98.70	94.16	89.25	82.62	76.45
	F – test	S	S	S	S	S	S
	S. Ed. (±)	0.44	0.20	0.11	0.23	0.20	0.26
	C.D at 5%	0.88	0.40	0.42	0.45	0.40	0.52
Packaging Materials (C)							
C_1	Plastic bag	99.00	97.08	93.39	89.18	82.12	76.72
C_2	Jute bag	98.25	96.39	90.29	83.37	75.79	67.58
	F – test	S	S	S	S	S	S
	S. Ed. (±)	0.31	0.14	0.14	0.16	0.14	0.18
	C.D at 5%	0.62	0.28	0.29	0.32	0.28	0.36

Table 2: Mean Seed germination percent of Influence of polymer coating, biocide and packaging materials on storability of wheat seeds.

Factor			**Seed Germination (%)**				
Genotypes (G)		**3 month**	**6 month**	**9 month**	**12 month**	**15 month**	**18 month**
V_1	Dorokhshan-08	97.03	94.25	88.81	84.00	75.81	69.84
V_2	PBW-154	96.87	94.65	89.15	83.46	76.12	70.03
V_3	Gul – 96	96.93	94.62	89.31	83.87	76.03	70.25
	F – test	S	S	S	S	NS	S
	S. Ed. (±)	0.40	0.35	0.54	0.53	0.71	1.04
	C.D at 5%	0.80	0.70	1.09	1.06	1.42	2.09
Seed treatments (T)							
T_0	Control	95.54	89.16	82.70	75.62	65.54	59.37
T_1	Neem oil @10 ml/kg	97.29	95.79	91.04	86.37	79.04	72.58
T_2	Polymer Coating 2 9 ml/ kg	97.29	96.58	91.20	86.37	79.58	73.75
T_3	Carbendazim12% + Mancozeb63% W.P 2 2.5 gm / kg	97.66	96.50	91.41	86.75	79.79	74.45
	F – test	S	S	S	S	S	S
	S. Ed. (±)	0.46	0.40	0.63	0.61	0.82	1.20
	C.D at 5%	0.92	0.80	1.26	1.22	1.64	2.41
Packaging Materials (C)							
C_1	Plastic bag	97.47	94.83	90.64	86.68	79.10	74.47
C_2	Jute bag	96.41	94.18	87.54	80.87	72.87	65.60
	F – test	S	S	S	S	S	S
	S. Ed. (±)	0.32	0.28	0.44	0.43	0.58	0.85
	C.D at 5%	0.65	0.57	0.89	0.86	1.16	1.70

Table 3: Seedling length (cm) of Influence of polymer coating, biocide and packaging materials on storability of wheat seeds.

Factor		**Seedling length (cm)**					
Genotypes (G)		**3 month**	**6month**	**9 month**	**12 month**	**15 month**	**18 month**
V_1	Dorokhshan-08	26.87	24.46	21.38	19.11	16.87	13.44
V_2	PBW-154	28.19	25.93	22.21	20.38	18.31	14.70
V_3	Gul – 96	28.28	25.13	21.49	19.51	17.80	13.92
	F – test	S	S	NS	S	S	S
	S. Ed. (±)	0.56	0.45	0.39	0.33	0.24	0.26
	C.D at 5%	1.13	0.91	0.79	0.66	0.49	0.53
Seed treatments (T)							
T_0	Control	26.80	23.87	19.75	18.26	15.90	11.62
T_1	Neem oil @10 ml/kg	27.82	25.31	21.86	19.98	17.88	14.20
T_2	Polymer Coating 2 9 ml/ kg	28.34	25.47	22.09	19.48	17.91	14.64
T_3	Carbendazim12% + Mancozeb63% W.P 2 2.5 gm / kg	28.15	26.05	23.06	20.95	18.97	15.61
	F – test	NS	S	S	S	S	S
	S. Ed. (±)	0.65	0.52	0.46	0.38	0.28	0.30
	C.D at 5%	1.30	1.05	0.91	0.76	0.57	0.61
Packaging Materials (C)							
C_1	Plastic bag	28.56	26.27	22.63	20.58	18.60	15.20
C_2	Jute bag	26.99	24.07	20.75	18.76	16.73	12.84
	F – test	S	S	S	S	S	S
	S. Ed. (±)	0.46	0.37	0.32	0.27	0.20	0.21
	C.D at 5%	0.92	0.74	0.65	0.54	0.40	0.43

Table 4: Mean seed vigour percent of Influence of polymer coating, biocide and packaging materials on storability of wheat seeds.

Factor		Seed vigour (%)					
Genotypes (G)		**3 month**	**6 month**	**9 month**	**12 month**	**15 month**	**18 month**
V_1	Dorokhshan-08	84.00	81.12	76.71	70.75	63.21	55.25
V_2	PBW-154	83.84	81.65	77.15	70.37	63.87	55.96
V_3	Gul – 96	83.87	81.62	77.31	70.65	63.78	56.18
	F – test	S	S	S	S	S	S
	S. Ed. (±)	0.40	0.33	0.45	0.44	0.55	1.02
	C.D at 5%	0.80	0.66	0.91	0.87	1.11	2.04
Seed treatments (T)							
T_0	Control	82.45	76.00	70.58	62.33	52.87	44.41
T_1	Neem oil @10 ml/kg	84.25	82.79	79.04	73.25	66.79	58.62
T_2	Polymer Coating 2 9 ml/ kg	84.25	83.58	79.20	73.12	67.29	59.58
T_3	Carbendazim12% + Mancozeb63% W.P 2 2.5 gm / kg	84.66	83.50	79.41	73.66	67.54	60.58
	F – test	S	S	S	S	S	S
	S. Ed. (±)	0.46	0.38	0.52	0.50	0.64	1.18
	C.D at 5%	0.93	0.76	1.05	1.01	1.28	2.36
Packaging Materials (C)							
C_1	Plastic bag	84.41	81.83	78.64	73.54	66.83	60.39
C_2	Jute bag	83.39	81.10	75.47	67.64	60.41	51.20
	F – test	S	S	S	S	S	S
	S. Ed. (±)	0.33	0.27	0.37	0.35	0.45	0.83
	C.D at 5%	0.65	0.54	0.74	0.71	0.91	1.67

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