INFLUENCE OF STORAGE PERIODS, PACKING MATERIALS AND SEED TREATMENTS ON GERMINATION MOISTURE CONTENT AND VIGOUR OF WHEAT (*TRITICUM AESTIVUM* L) AND SOYBEAN (*GLYCINE MAX*.L)

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Abstract: The cultivated species "*Triticum aestivum* L." belongs to the family Graminae (poaceae) and "*Glycine max*. L." belongs to family leguminosae. Both grain, are dominant in global agricultural production. Wheat "*Triticum aestivum* L." and Soybean "*Glycine max* L." seeds are one of the most important nutritional crops and proper storage of these seeds continues to be a challenge for farmers. Present study was under taken to examine the effect of storage periods, storage materials and different seed treatments on seed quality of wheat "*Triticum aestivum* L." and Soybean *"Glycine max* L." . For this, a storage experiment was conducted in Govt. Madhav Science PG College Ujjain (M.P) during 2013 and 2014. Freshly harvested wheat "*Triticum aestivum* L." and Soybean *"Glycine max* L." Seeds of variety "HI-1479(SWARNA) and JS-9560" were collected from Krishi Vigyan Kendra (KVK) Ujjain. The seeds were treated with Castor oil (5ml/Kg), Captan (3g/kg), Vitavex (3g/kg) and control (untreated) packed in cloth bags and Polybags stored for 3-9 months under ambient conditions at MVM Ujjain (M.P). The results showed that seeds treated with Captan (T_2) recorded significantly higher germination (75.48%) in Wheat and 60.5% in Soybean seeds and for storage materials Cloth bags (C_1) recorded significantly higher germination (67.49%) and higher vigour index (1439) in Wheat whereas, in Soybean Poly bags (C_2) recorded maximum germination % (42%) and higher vigour index(663). And for moisture content, Cloth bags recorded maximum moisture %(4.88 %) in Wheat and for Soybean Poly bags (C_2) recorded maximum moisture %(8.9%) at the end of 9-month storage period. Overall, results showed that among the storage sources, and seed treatments, Captan and Cloth bags were found suitable for maintaining seed quality of Wheat grains, whereas, for storing Soybean seeds Captan and Polybags were found suitable for maintaining seed quality during the entire storage periods.

Keywords: Wheat "*Triticum aestivum* L." Soybean *"Glycine max* L.", Storage periods, Storage materials, Seed treatments, Germination, Moisture content, Vigour index.

Introduction: Wheat (*Triticum aestivum* L.) is the most important crop in the world and also in Madhya Pradesh. This crop is among the major three cereal crops that provided 20 percent of the energy in human food. Wheat grain, as well as corn and rice, is dominant in global agricultural production. Currently, India is the second largest producer of Wheat in the world after China with about 12% share in total world Wheat production.

Soybean designated as "miracle bean" has established its potential as an industrial vital and viable oilseed crop in many areas of India. Soybean mainly on account of its dietic, industrial, agricultural; and medicinal Importance, its products have various uses. Together, these two crops decide the agricultural economy of the state particularly in the area dominated by medium to deep black soils covering an area of over 16.5 million hectares. The predominant cropping system is the wheat- soybean system followed by soybean-chickpea. As a result of to sustain higher productivity of the above two crops the seed of good quality, in terms of genetic material, having good germination, vigour is of paramount importance when it reaches the farmers field. Seed producing agencies need to be apprised of the conditions which enable them safe storage without affecting the quality during storage due to storage material and seed treating pesticides.

The storage of grains is practiced from the era of the beginning of civilization. Proper storage plays an important integral part in maintaining quality characters of these seeds. Such as seed germination, moisture content, seed discoloration and seed- borne fungal prevalence have long been known to be influenced by various factors during storage. Fluctuation in temperature, humidity and prolonged storage results in considerable nutrient loses (Shah et al., 2002).

In modern age, packing has become very important because of protection of the product from contamination by macro and micro-organisms and their filth, prevention from loss or grain of moisture, shielding the product from oxygen and to facilitate handling (Ball, 1960).

Environmental temperature and relative humidity are two important factors influencing seed viability and longevity during the storage periods. Interdependence of these two factors during seed storage and their subsequent effect on grain moisture has been recognized by Harrington who suggested the three "rules of thumbs "regarding optimal seed storage. Prolonged storage with high moisture

content also causes reduction in seed quality parameters. To maintain the quality of seeds during storage, suitable seed treatments and packing materials are most important because seed treatment is the basic measure to assure an adequate health of crops at emergence and during further growth of plants. In storage, seeds are to be protected against the pests and pathogens. Seed treatments with different fungicides not only controls seed- borne diseases, but also improves seed health, seed quality parameters and crop yield (Tanweer 1982).

Fungicidal treatments are required for seeds stored for several months without affecting the seed health adversely. Off late, attempts have been made to replace synthetic (inorganic) seed treatment chemicals with organic materials of plant origin which are cheaper, safe and eco-friendly (Parashivamurthy, 1994). Keeping in view these facts, the objectives of the research were aimed to determine the effects of storage periods, storage materials and seed treatments on seed quality characters of Wheat and Soybean seeds during storage from 3-9 months.

Materials And Methods:

- **Sample Collection:** Samples of freshly harvested grains of Wheat"HI-1479 (SWARNA)"and Soybean "JS-9560" were collected during the years 2013-2014 from Krishi Vigyan Kendra (KVK) Ujjain (M.P.).

  EXPERIMENTAL DETAILS
- **Treatment details:** The experiment consisting of three storage periods viz., 3,6 and 9 months, two packing materials (Cloth bags and Poly bags) and four seed treatments including control one.

The details of the experiment are furnished below:

Factor I: STORAGE PERIODS

3-Month, 6- Month and 9-Month

Factor II: PACKING MATERIAL

C_1 : Cloth bag

C_2 : Poly bag

Factor III: SEED TREATMENTS

T_1: Castor oil, T_2: Captan, T_3: Vitavex. T_4: Control

Biometric Observations:

- **Moisture Content (%):** The moisture content of seed samples were determined by using low constant oven method following the guidelines of International Seed Testing Association (ISTA). The moisture was measured just after collection of seed from the KVK Ujjain. For each treatment 15 g seed was taken into a crucible and weighed. Then the crucible was kept in an electric oven maintained at a temperature of 75°C for a period of 24 hours for proper drying of the seed sample. After cooling the weight of dish plus its cover and contents were taken. Then the moisture content of the seed sample was calculated with the help of the following formula (ISTA, 2007).

Seed moisture content =

$$\frac{M1 - M2}{M1} \quad X \quad 100$$

Where,

M1 = Fresh weight of the Seeds.

M2 = Dry weight of the Seeds.

- **Germination Test:** For germination test, it was done on field performance evaluation along with pro- trays filled with compost and coco-pit and about 100 seeds were planted at 1cm depth at an equal spacing. They were arranged in a randomized design (RBD) with three replicates for each treatment. No other fertilizers were added but adequately watered.
- **Vigour Index (Vi):** Vigour index was calculated as per Abdul-baki and Anderson (1973) by using the formula;

  VI= Germination percentage (%) x Total seedling length (cm)
- **Data Analysis:** The mean values of data obtained were statistically analyzed by two way ANOVA using RBD design for parameters like moisture content, germination percentage and vigour index.

Result And Discussion: The results of the, germination percentage, moisture content and vigour index of seeds of wheat and Soybean during 3-9 months of storage as influenced by various seed treatments and different storage materials are presented in tables 1 to 3.

Germination Percentage (%): The data on germination percentage as influenced by storage periods, packing materials and seed treatments are presented in table 1 and Figure 1 and 2.

The results of the present study indicated that seed treatments had produced significant effect on seed germination. Seeds treated with Captan (T_2) recorded significantly higher germination (75.48%) in Wheat and (60.5%) in Soybean. Whereas seeds without treatment (Control) (T_4) observed lower germination (58.73%) followed by seeds treated with castor oil (T_1) 61.95% in Wheat and for Soybean Vitavex (T_3) recorded (29.3%) at the end of 9-month storage period. The germination percentage varies significantly due to packing materials and their interaction effects at the end of 9-month storage period.

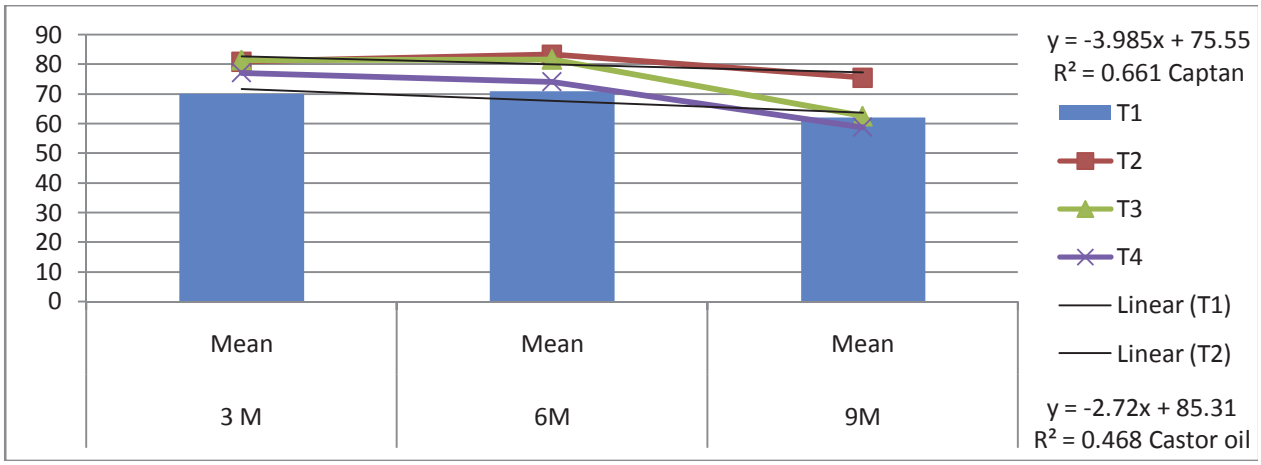

Figure 5. Germination in Wheat

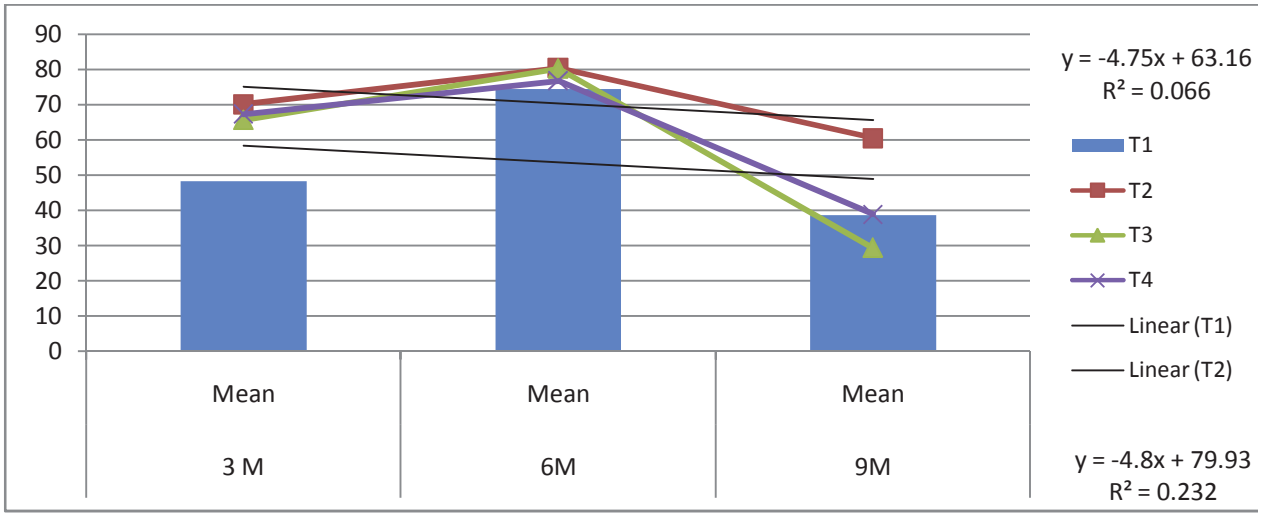

Figure 6. Germination in Soybean

A significant higher germination percentage is found in seeds treated with Captan T_2 (75.48%) may be due to effective control of storage diseases and insect pests, whereas the chemicals acted as antioxidants to counteract the release of free radicals during the storage period. On the other hand minimum seed germination occurs in untreated seeds (T_4) and seeds treated with castor oil (T_1) and Vitavex (T_4) in both the crops may be due to duration of storage periods (ageing) or due to deleterious effect on seeds and also castor oil makes a thin cover over the seed and due to which processes like respiration and other metabolic activities gets inhibited which affects the seed germination process. The above two figures clearly shows that seeds of both the crops treated with Captan (T_2) recorded highest seed germination as compared to other seed treatments at the completion of 9-months storage period. Also, the two figures shows that during the entire storage period from 3-9 month rate of germination declined faster in soybean as compared to wheat, which may be due varying environmental conditions during the whole storage periods and the differential leaching behavior of two crops.

Packing materials produced significant effects on the germination percentage at the end of the 9-month storage period. Among the packing materials seeds stored in Cloth bags (C_1) observed significantly higher germination (67.49%)in Wheat and Polybags bags C_2 (42%) in Soybean at the end of 9-month. Significant higher seed quality parameters in the seeds stored in Cloth bags and Polybags may be due to changing environmental conditions during the entire storage periods.

Moisture Content (%): The result of the present study indicates that the moisture content of both seeds during entire storage periods differed significantly among packing materials at 3 - 9 months of storage period as shown in table 2. The results shows that the seeds stored in cloth bags (C_1) recorded highest moisture content (4.9%) in Wheat and Polybags (C_2) recorded (8.9%) in Soybean at the

end of 9-month storage period. Differences in moisture content due to seed treatments and their interaction were non-significant. Cloth bags (C_1) and Polybags (C_2) showed fluctuation in moisture content and recorded higher and lower moisture content in seeds at the end of 9-month storage period may be due to high relative humidity of storage go-downs during the storage period with the start of monsoon rain. And because of this reason cloth bags acts as pervious containers as compared to Polybags which acts as impervious container. Moisture content of seeds stored in cloth bags exhibited a lot of fluctuation and as also higher compared to the seeds stored in Polybags throughout the storage period. Similar results were observed by (Baskin et al., (1987) and Kurdikeri (1991).

Vigour Index (Vi): The data on vigour index as influenced by storage periods, Storage materials and seed treatments at the end of 9-month are presented in table 3.

The data obtained at the end of 9-month storage period shows significant differences in vigour index (VI) due to different seed treatments as well as packing materials. Among the seed treatments, seeds treated with Captan (T_2) recorded significantly higher vigour index (2024) and 1261 in Wheat and Soybean. Significant differences in vigour index were noticed due to packing materials during storage period. Seeds packed in Cloth bags (C_1) recorded significantly higher vigour index (1,439) in Wheat and seeds packed in Polybags (C_2) recorded higher vigour index (663). Among packing materials vigour index values registered by C_1 and C_2 were decreases as compared to 3-6 month storage periods in both the crops. This may be due to values of vigour decreased with advancement of storage periods and increases the moisture contents during storage periods. Interaction of seed treatments and packing materials shows non-significant difference. However, viability of seeds is not only influenced by relative humidity and consequently grain moisture content, but also with seed temperature. As shown by Cardwell (1984) seed vigour gets lowered with the increase of seed moisture especially in environment with high temperature and relative humidity.

Conclusion: The present research reiterated the importance of proper storage techniques and different seed treatments and their impact on seed quality parameters of both the seeds. Considering the changes in the quality parameters storage materials and seed treatments have a major role in protecting the seeds during storage and can play an important role in achieving uniform seedling emergence under changing environmental conditions.

The present study revealed that the seeds of both the crops were treated with Captan (T_2) maintain maximum seed quality parameters like; germination %, moisture content and vigour index and for packing materials Cloth bags (C_1) shows maximum seed quality parameters in Wheat and (C_2) shows maximum seed quality parameters in Soybean stored for 3-9 months under ambient conditions. Considering the changes in the quality parameters studied during entire storage periods, it is suggested that Wheat seeds stored in Cloth bags treated with Captan (T_2) and Polybags treated with Captan (T_2) performs better results for storing wheat and Soybean grains in changing environmental conditions were temperature and relative humidity varies. But, overall research findings also reveals that seed quality parameters declined progressively with the increase of storage period and other varying related environmental conditions and characters.

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Comparing S.Em ±	S.Em ±	C.D	S.Em ±	C.D	S.Em ±	C.D	S.Em ±	C.D	S.Em ±	C.D	S.Em ±	C.D
C	1.575	4.822	0.400	1.224	1.983	6.072	3.68	11.27	1.09	3.34	1.74	5.32
T	1.113	N/A	0.283	N/A	1.402	4.294	2.60	7.97	0.77	N/A	1.23	N/A
C x T	2.227	N/A	0.565	1.731	2.804	N/A	5.20	15.94	1.54	N/A	2.46	7.53

Comparing	S.Em ±	C.D	S.Em ±	C.D	S.Em ±	C.D	S.Em ±	C.D	S.Em ±	C.D	S.Em ±	C.D
C	0.073	0.225	0.013	0.041	0.126	0.387	0.022	0.068	0.021	0.063	0.015	0.046
T	0.052	0.159	0.009	0.029	0.089	0.274	0.016	0.048	0.015	0.044	0.011	0.032
C x T	0.104	0.318	0.019	0.058	0.179	0.548	0.031	0.096	0.029	0.089	0.021	0.064

Comparing	S.Em ±	C.D	S.Em ±	C.D	S.Em ±	C.D	S.Em ±	C.D	S.Em ±	C.D	S.Em ±	C.D
C	144.8	443.6	70.7	216.5	94.8	290.5	95.04	291.0	214.7	N/A	40.4	123.9
T	102.4	313.7	50.0	N/A	67.0	N/A	67.2	205.8	151.8	N/A	28.6	87.6
C x T	204.8	N/A	100.0	N/A	134.1	N/A	134.4	411.6	303.7	N/A	57.2	175.2

Table1 . Influence of seed treatment and packing materials on germination (%) in Wheat and Soybean during storage

Treatment T	Wheat									Soybean								
	3 Month			6 Month			9 Month			3 Month			6 Month			9 Month		
	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean
T_1	68.1	71.73	69.92	71	70.73	70.87	65.23	58.67	61.95	33.8	62.5	48.1	76.8	71.8	74.3	46.5	30.7	38.6
T_2	81.97	79.87	80.92	82.83	83.6	83.22	77.43	73.53	75.48	79.5	60.7	70.1	78.6	82.2	80.4	43.2	77.9	60.5
T_3	81.03	81.63	81.33	80.2	82.97	81.58	67.83	57.27	62.55	81.4	49.8	65.6	81.4	79.1	80.2	31.0	27.7	29.3
T_4	77.3	76.73	77.02	76.77	71.43	74.1	59.47	58	58.73	78.6	56.0	67.3	77.4	76.1	76.7	45.4	32.2	38.8
Mean	77.1	77.49		77.7	77.18		67.49	61.87		73.4	57.2		78.5	77.3		41.5	42.1	

Table2. Influence of seed treatment and packing materials on moisture content (%) in Wheat and Soybean during storage

Treatments	Wheat									Soybean								
	3 Month			6 Month			9 Month			3 Month			6 Month			9 Month		
	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean
T_1	7.3	6.2	6.8	8.0	7.2	7.6	5.4	4.3	4.9	6.5	7.3	7.0	11.0	9.6	10.2	8.6	9.3	9.0
T_2	7.1	6.7	6.9	8.2	8.1	8.1	4.8	5.0	4.9	5.9	5.0	5.5	8.4	9.3	8.8	9.0	9.1	9.1
T_3	6.7	7.5	7.1	8.4	7.5	7.9	4.5	3.1	3.8	7.6	7.0	7.2	11.0	9.4	10.2	8.4	8.8	8.6
T_4	7.4	7.0	7.2	8.4	8.2	8.3	4.8	4.3	4.6	6.3	6.7	6.5	10.0	9.8	9.8	8.9	8.5	8.7
Mean	7.1	6.8		8.2	7.8		4.9	4.2		6.5	6.5		10.1	9.5		8.7	8.9	

Table3. Influence of seed treatment and packing materials on vigour index (VI) in Wheat and Soybean during storage

Treatment (T)	Wheat									Soybean								
	3 Month			6 Month			9 Month			3 Month			6 Month			9 Month		
	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean
T_1	1,381	1,980	1,681	1,478	1,349	1,413	1,194	1,006	1,100	1045	621	833	2797	2590	2694	519	208	363
T_2	2,220	3,031	2,625	2,415	2,490	2,452	2,110	1,939	2,024	274	961	568	1783	1783	1976	491	2,031	1,261
T_3	2,341	2,835	2,588	2,460	2,801	2,631	1,370	1,071	1,221	1944	626	1285	2098	2098	2489	227	186	207
T_4	2,631	2,486	2,558	2,021	1,772	1,897	1,080	974	1,027	1060	855	957	2285	2285	2420	492	227	359
Mean	2,143	2,583		2,094	2,103		1,439	1,248		1081	741		2189	2189		432	663	

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