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Effect of seed coating treatments on germination and vigour of wheat (*Triticum aestivum* L.) during ambient storage

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Abstract
An experiment was conducted to study the "Effect of seed coating treatments on germination and vigour of wheat during ambient storage". The seeds of wheat HD 2967 were coated with polymer, fungicides and various growth products i.e. T_1-Thiram only, T_2-Polymer coating (Disco AGSP Red L-200) + Thiram + Carboxine, T_3-Polymer coating (Disco AGSP Red L-200) + Thiram + Genius coat, T_4-Polymer coating (Disco AGSP Red L-200) + Thiram + Quick root. The doses were 3g/kg for polymer and 2g/kg for thiram, carboxine, genius coat and quick root. Bimonthly observations were recorded during ambient storage (range of average R.H. from 45.36 to 84.74% and temperature 15.14 °C to 30.55 °C) i.e. from Sep. 2015 to Sep. 2016 on germination (%), seedling length (cm.), seedling dry weight (g.), SVI-1 & II and field emergence (%) on 10th and 30th days in season. It may be concluded that seed coating treatment of Polymer + Thiram + Quick root was best for maintaining maximum longevity and vigour during ambient storage of 12 months of wheat HD2967 because it maintained significantly highest germination (79.33%), seedling length (10.12cm.), seedling dry weight (0.183g.), SVI-I (802.81) and SVI-II (14.51) with minimum percent reduction over initial i.e. 12.82, 45.88, 49.16, 52.83, 55.70 % respectively, along with significantly maximum field emergence in season at 10th (88%) and 30th days (86.70%). Next to this treatment was Polymer + Thiram+ Genius coat. Longevity in terms of germination i.e. above IMSCS (85%) can be maintained for eight months by Polymer + Thiram + Quick root and for six months by Polymer + Thiram + Carboxine and Polymer + Thiram + Genius coat.

Keywords: seed coating treatments, germination, vigour, wheat and ambient seed storage

Introduction
Proper storage conditions are important for maintaining valuable seeds. Seed viability and vigour are highest at the time of physiological maturity thereafter the seed gradually declines in viability and vigour. Seed is stored form the moment as it attains physiological maturity on the plant. Seeds are stored under optimal storage conditions (low temp. and humidity with low seed moisture content) to prolong the seed viability. Seed coating is a process of applying useful materials to form a continuous layer of thin coating over the seed without altering the shape or size by employing water as the solvent. Seed coating can be broadly classified into three categories namely seed pelleting, film coating and seed coloring. Seed coating is a technique adopted on cleaned/graded seed at any stage between post-processing and pre-sowing, where in external material is applied to the seed without altering its shape. Polymer is a film coating chemical being applied in recent years, over seeds, without significantly increasing its size or weight. This kind of plasticizer polymer forms a flexible film that prevents seed coat pelleting, dusting off and loss of fungicide during handling and is readily soluble in water (hydrophilic), so as not to impede with normal germination. The positive and significant response of seed coating alone or combination with insecticide, fungicide, bio-agents and natural fillers on germination plant growth, seed yield and quality seed storability have been reported by several workers (Sharien, *et al.* and Jitendra *et al.* 2007) [2] in indian mustard, maize, cowpea and soybean.
The aim of this study was to evaluate the effect of seed coating treatments on germination and vigour during ambient storage and to select out the best seed coating treatment for maintaining maximum longevity.

Materials and Mehods
This experimental work was carried out in the Seed Testing Laboratory and field of the department of Seed Science and Technology, C.S.A. University of Agriculture and Technology, Kanpur. The coated seeds of wheat HD 2967 were supplied by Special officer

(Seed) ICAR, New Delhi and after coating with polymer, fungicides and various growth products *i.e.* T_1-Thiram only, T_2-Polymer coating (Disco AGSP Red L-200) + Thiram + Carboxine, T_3-Polymer coating (Disco AGSP Red L-200) + Thiram + Genius coat, T_4-Polymer coating (Disco AGSP Red L-200) + Thiram + Quick root. Seed coating has been done by INCOTEC, Ahmedabad as per given detail:-

Detail of seed coating material and its doses

Chemical	Patent no.	Conc.	Function
Polymer (Disco AGSP Red L-200)	-	3 g/kg	Adhesive
Thiram	-	2 g/kg	Fungicide
Carboxine	-	2 g/kg	Fungicide
Genius coat	5.06.172	2 g/kg	Activates metabolic process in the developing embryo of the plant. Increases root development and mass, maximizing plants ability to utilize nutrients. Improve stress tolerance and crop viability.
Quick root	5.09.157	2 g/kg	Colonizes roots in symbiotic relationship-produces enzymes which release soil nutrients has been shown to increase NPK uptake by increasing the volume of roots.

Among T_1 to T_4 the range of seed moisture content was 10 to 12.5%. During storage the range of average humidity and temperature were 45.36% to 84.74% and 15.14 ^{0}C to 30.55 ^{0}C, respectively. After taking initial observations on seed moisture content, germination and vigour each lot was packed in cloth bag in three replications and stored under ambient conditions. During storage observation were recorded on seed germination (%), seedling length (cm), seedling dry weight (g), SVI- I & II and field emergence (%) at 10 & 30 days. The various statistical techniques were used for calculation of the data as suggested by Fisher and Yates (1947) [1]. The experiment was conducted in completely randomized design (CRD) for laboratory test and randomized block design (RBD) for field experiment.

Results and Discusion

Seeds of wheat variety were treated with Thiram (T_1), Polymer + Thiram + Carboxine (T_2), Polymer + Thiram + Genius coat (T_3) & Polymer + Thiram + Quick root (T_4) and stored in the month of September, 2015 for 12 months under ambient conditions. The range of average temperature and humidity were 15.14 ^{0}C to 30.55 ^{0}C and 45.36 to 84.74%, respectively, during storage period i.e. from Sep., 2015 to Sep. 2016. Initially, when the treated seeds were kept in cloth bag for storage, the germination was 84.00, 90.00, 94.00 & 91.00%, seedling length was 18.00, 18.30, 19.00 & 18.70 cm, Seedling dry weight was 0.340, 0.360, 0.380, & 0.360 g. seedling vigour index -I was 1512, 1647, 1786 & 1702 and seedling vigour index -II was 25.56, 32.40, 35.72 & 32.76 in T_1, T_2, T_3 & T_4, respectively. Means of parameters were presented in table 1, 2 & 3 and figures 1, 2 & 3.

Significant effect of seed coating treatments was observed in all parameters like germination, seedling length, seedling dry weight, SVI-I &II 0, 2, 4, 6, 8, 10 and 12 months of ambient storage and emergence at 10 & 30 days in season except seedling length & seedling dry weight in 0 months, SVI-I in 10 month. Significant effect of various coating treatments was observed by various scientists like Rao *et al.* 2015 [5] and Vanangamudi *et al*. 2003 [7].

Coated seeds by Polymer + Thiram + Quick root showed the best performance for maintaining longevity and showed significantly highest values of germination, seedling length, seedling dry weight, SVI-I and SVI-II were 79.33%, 10.12 cm, 0.183, 802.81 & 14.51 respectively, at the end of ambient storage period i.e. in 12 month. This treatment also exhibited minimum reduction over initial among all treatments and showed 12.82, 45.88, 49.16, 52.83 & 55.70% reduction in germination, seedling length, seedling dry weight, SVI-I & SVI-II, respectively. Similar beneficial effect of seed coating was found by Verma and Verma (2014) [8] in soybean, Kausik and Kumar (2014) [3] in maize, Rao *et al.* (2015) [5] in hybrid cotton and Nethra *et al.* (2016) [4] in hybrid maize.

Treatment of Polymer + Thiram + Genius coat showed at par performance to the best one is Polymer + Thiram + Quick root regarding germination (78.00%), seedling length (9.80 cm), SVI-I (764.40) and second best performance regarding seedling dry weight (0.171g.) and SVI-II (13.33) at the end of storage month i.e. 12 month of storage as well as percent reduction over control was lesser than Polymer + Thiram + Carboxine and Thiram only.

Polymer + Thiram + Carboxine treated seeds showed second best performance regarding germination 75.33% i.e. next to Polymer + Thiram + Quick root and Polymer + Thiram + Carboxine at the end of storage period i.e. in 12th month of storage but other seed quality parameters have shown inferior performance and at par to most inferior Thiram treated seeds. In Polymer + Thiram + Carboxine treatment, percent reduction over initial was 16.3, 54.48, 54.72, 61.90 and 62.12 and in only Thiram treated seeds it was 21.42, 53.55, 52.94, 553.50 and 58.68 in germination, seedling length, seedling dry weight, SVI-I & SVI-II, respectively.

Treatment of Polymer + Thiram + Quick root was the best for maintaining maximum longevity and vigour during ambient storage of 12 months of wheat HD 2967. Next to this, was coating treatment of Polymer + Thiram+ Genius coat Germination above IMSCS (85%) can be maintained for eight months by treatment of Polymer + Thiram+ Quick root, for six months by Polymer + Thiram + Carboxine, Polymer + Thiram + Genius coat and for two months by only Thiram treated seeds.

Table 1: Effect of seed coating treatments on germination (%) of wheat seeds

Treatment	Period of storage (month)							Mean	% Reduction Over Initial
	0	2	4	6	8	10	12		
Thiram Only (T_1)	92.00	85.33	83.66	81.66	80.33	78.33	72.00	79.90	21.42
Polymer + Thiram + Carboxine (T_2)	90.00	90.00	88.66	85.33	84.00	82.66	75.33	85.56	16.30
Polymer + Thiram + Genius Coate (T_3)	94.00	94.00	86.67	86.00	82.66	80..00	78.00	85.90	17.02
Polymer + Thiram + Quick Root(T_4)	91.00	92.00	90.00	88.33	86.33	83.33	79.33	87.18	12.82
SE (D)	1.15	1.54	1.05	0.76	0.81	0.57	1.23		
CD at 0.05	3.76	5.01	3.44	2.50	1.88	1.33	2.83		

Table 2: Effect of seed coating treatments on seeding vigour index-I of wheat seeds

Treatment	Period of storage (month)							Mean	% Reduction OverInitial
	0	2	4	6	8	10	12		
Thiram Only (T_1)	1512.00	1593.96	1501.23	131.40	1270.96	1088.17	551.76	1092.78	63.50
Polymer + Thiram + Carboxine (T_2)	1647.00	1375.20	1296.88	1095.31	1050.37	925.40	627.49	1145.37	61.90
Polymer + Thiram + Genius Coate (T_3)	1786.00	1922.01	1265.01	1121.75	1084.43	923.06	764.40	1261.52	57.20
Polymer + Thiram + Quick Root(T_4)	1702.00	2136.28	1257.44	1103.02	1072.73	982.56	802.81	1293.83	52.83
SE (D)	15.01	32.90	29.22	62.33	46.75	35.99	6.82		
CD at 0.05	48.90	107.15	95.18	100.04	.107.69	83.90	48.67		

Table 3: Effect of seed coating treatments on seedling vigour index-II of wheat seeds

Treatment	Period of storage (month)							Mean	% Reduction Over Initial
	0	2	4	6	8	10	12		
Thiram Only (T_1)	25.56	23.12	20.83	16.93	16.38	14.85	10.56	18.28	58.68
Polymer + Thiram + Carboxine (T_2)	32.40	25.08	19.26	16.74	16.40	15.45	12.27	19.65	62.12
Polymer + Thiram + Genius Coate (T_3)	35.72	26.88	22.89	19.22	17.31	16.02	13.33	21.19	62.68
Polymer + Thiram + Quick Root(T_4)	32.76	24.89	23.76	19.42	18.32	17.26	14.51	21.56	55.70
SE (D)	0.74	0.32	0.52	1.00	0.44	0.77	0.28		
CD at 0.05	2.41	1.05	1.72	1.70	1.03	N.S.	0.66		

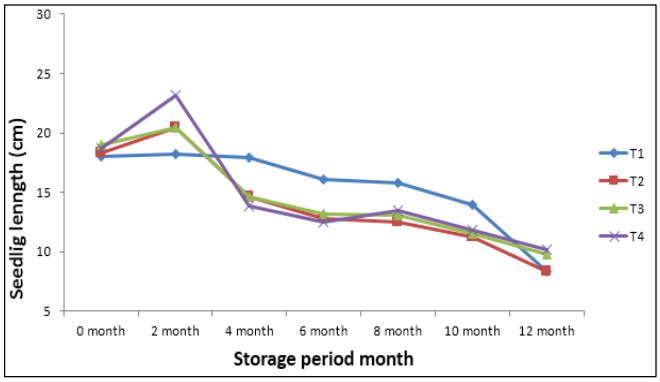

Fig 1: Effect of seed coating treatment on seedling length of wheat seeds during storage period

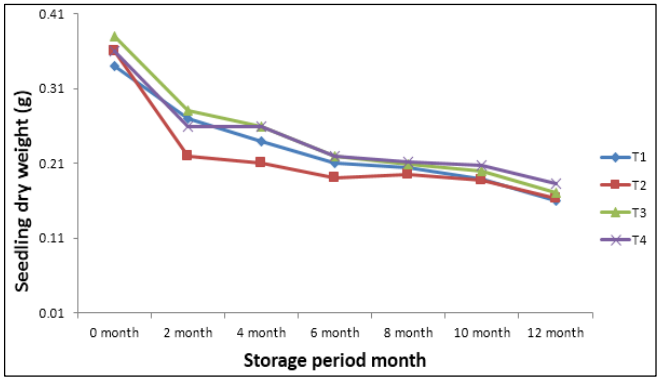

Fig 2: Effect of seed coating treatment on seedling dry weight of wheat seeds during storage

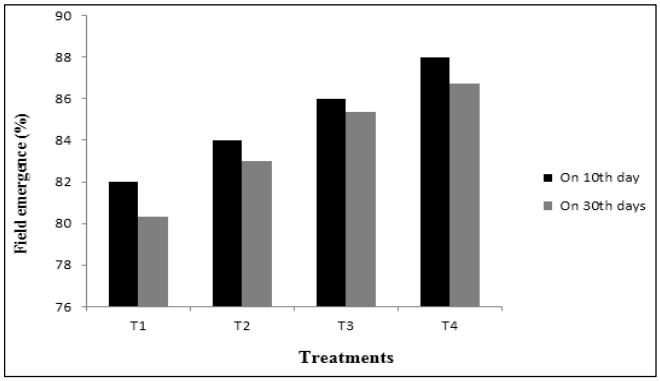

Fig 3: Effect of seed coating treatment on field emergence of wheat seeds

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