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INFLUENCE OF SEED COATING WITH SYNTHETIC POLYMERS AND CHEMICALS ON SEED QUALITY AND STORABILITY OF HYBRID RICE (*Oryza sativa* L.)

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ABSTRACT

Maintenance of seed vigor and viability during storage is a matter of prime concern. Research on storability of hybrid rice in India is of recent origin. Freshly harvested seed produce of F_1 hybrid rice KRH-2 were dried to safe level moisture (<13%), graded to uniform size and used for the study. The seeds were treated with synthetic polymers viz. Polykote TM and Littles Polykote W Yellow. Then the ploy-coated seeds were shade dried and further treated with chemicals viz. Captan, Thiram, Gouch and super red at recommended dosage. Seed senescence or deterioration is irreversible and inexorable process. Amount of moisture in seeds is probably the most important factor influencing seed viability during storage. The seed coated with littles polykote W yellow, captan + thiaram + gouch + super red at 1 ml/kg and stored in polythene bag (700 gauge) recorded higher germination (85.67%) as against the lowest recorded in cloth bag untreated 62% at the end of the storage period. The polymer littles polykote W yellow + captain + thiram + gouch treated seeds that were stored in polythene bag recorded highest field emergence (80%) compared to other treatments and control.

Keywords: seed coating, synthetic polymer

INTRODUCTION

Rice (*Oryza sativa* L.) is a major dietary staple food for higher percentage of the world's population particularly in Asia, where more than 90 per cent of rice is grown. India has emerged as the second largest hybrid rice-growing country in the world (Yuan 1997). However, the success in hybrid rice in India could be visualized only if the adequate quantities of quality hybrid seeds are made available to the farming community (Ponnusamy *et al.*, 2000).

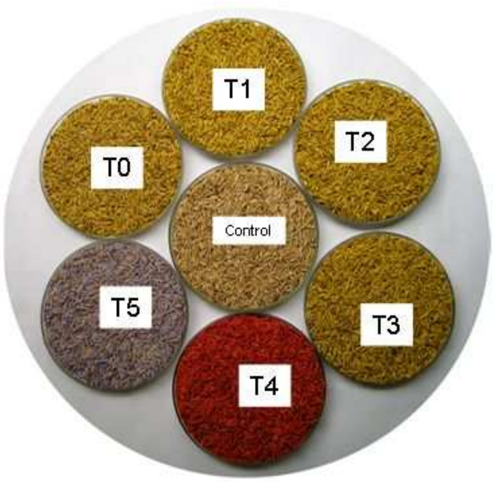
Maintenance of seed vigor and viability during storage is a matter of prime concern in India. Owing to the prevailing sub-tropical climate in the major parts of the country, seeds of most crop species show rapid deterioration and hybrid rice is no exception. In general, there are differences among species (Agrawal 1976) and also among varieties within a species (Agrawal 1978) with respect to loss of viability during storage of rice. Rame Gowda (1992) and Kalavathi *et al.* (1999) also reported differences in storability of rice hybrids and their parental lines.

Research on storability of hybrid rice in India is of recent origin. With the development of organized seed production and marketing system in India, seeds men are becoming aware of the problems of seed storage and thereby systematic research has been initiated. It is estimated that 80 per cent of the certified seeds produced in India require storage for at least one planting season and 20 per cent of the seed is carried over for subsequent sowings (Bal 1976). However, when the awareness and infrastructure develops, substantial quantity of seeds may be stored for few planting seasons as a safeguard against monsoon failure and other natural calamities.

Seed quality is a multiple concept comprising several physical, chemical and biological components. Seed being a biological or living entity, deterioration in its quality is inevitable, irreversible and inexorable. It occurs with advance in ageing, which is common for all the living organisms. Seed deterioration is a phenomenon, which begins immediately after attaining physiological maturity even on the mother plant itself (Helmer *et al.* 1962).

MATERIALS AND METHODS

Freshly harvested seed produce of F_1 hybrid rice KRH-2 procured from ZARS, V.C Farm, Mandya were dried to safe level moisture (<13%), graded to uniform size and used for the study. The seeds were treated with synthetic polymers *viz.* Polykote TM and Littles Polykote W Yellow. Then the ploy-coated seeds were shade dried and further treated with chemicals *viz.* Captan, Thiram, Gouch and super red at recommended dosage (Plate 1). They were packed in cloth bag and poly bags (700 gauges) and stored under ambient conditions at the Seed Technology Research Unit, GKVK, Bangalore for a period of ten months from August 2005 to July 2006 (Plate 2). The seed samples drawn at bimonthly intervals were evaluated for various seed quality attributes in order to determine the suitable polymer-chemical combinations for better storage of hybrid rice.



KRH-2 stored in polythene gags

KRH-2 stored in cloth bags

Plate 1. Seed coated with polymers and treated with chemicals

RESULTS AND DISCUSSION

Seed senescence or deterioration is irreversible and inexorable process. However, the rate of seed deterioration could be slowed down either by storing the seeds under controlled conditions or by imposing certain treatments with either chemicals or any other protectants. Seed coating with polymers is one such pre-storage treatment that can be used either singly or in combination with other pesticides to protect seeds against a pests and diseases. Duan and Burris (1997) explained the possibilities of using polymers along with other chemicals to ensure the keeping quality of seeds. The rapid deterioration of stored seed is a serious problem, particularly, in India where high temperature and relative humidity prevail and associate with accelerated ageing phenomenon. Since the controlled condition involves huge cost, the seed coating could be one of the best alternative approaches to maintain seed quality during storage.

Amount of moisture in seeds is probably the most important factor influencing seed viability during storage (table 1). The moisture was higher in the (control) T_0P_0 (13%) in the second month and at the end of storage was 14.30 per cent in cloth bag and lower moisture was in T_3P_4 (11.70%) in the second and at the end of storage was 12.80%. the rate of deterioration increases as the moisture content of seed increases. The fluctuation in the moisture was higher in cloth bag. It the seed moisture higher then there will be mould growth either with in the seed as the surface of seeds; further, even with the normal range, the biological activity of seeds (itself and mold) increases further as the temperature. In the present study, thought there was slight increase in the seed moisture over storage irrespective of container and treatments. It did not fluctuate much over storage particularly in polymer-coated seeds stored in either cloth bag or polythene bag mainly due the protection offered by these hydrophobic polymers, which prevented the absorption of moisture from storage environment (West *et al.* 1985). Moisture content in polythene bag stored seeds was with in the safer limit (<13%) when compared to cloth bag (14.30%) at the end of storage. Therefore, the viability of seeds in cloth bag declined rapidly than the seeds stored in polythene bag.

Table 1. Seed moisture content (%) as influenced by containers, polymers and chemical treatments during storage in rice hybrid KRH-2

Treatment	2nd month		4th month		6th month		8th month		10th month		Mean
	C_1	C_2	C_1	C_2	C_1	C_2	C_1	C_2	C_1	C_2	
T_0P_0	13.00	12.51	13.55	13.43	13.85	13.14	14.10	13.42	14.30	13.70	13.5
T_0P_1	12.55	12.48	13.50	12.75	13.74	12.98	14.05	13.25	14.21	13.46	13.3
T_1P_1	12.05	12.00	13.28	12.52	13.63	12.84	13.85	13.27	14.10	12.98	13.05
T_2P_1	12.05	11.99	13.30	12.22	13.52	12.66	13.80	13.15	14.05	13.05	12.98
T_3P_1	11.78	11.70	12.83	12.34	12.81	12.52	13.58	13.07	13.85	12.80	12.73
T_4P_1	12.17	12.12	12.79	12.18	13.56	12.50	13.48	12.99	13.75	13.09	12.86
T_0P_2	12.59	12.52	13.35	12.55	13.74	12.83	13.88	13.32	14.17	13.25	13.22
T_1P_2	12.03	11.98	13.24	12.40	13.38	12.65	13.56	13.23	13.90	12.96	12.93
T_2P_2	12.32	12.26	13.28	12.48	13.32	12.59	13.43	13.20	13.80	13.06	12.97
T_3P_2	12.12	12.10	12.74	12.38	13.33	12.41	13.35	13.05	14.11	13.09	12.87
T_4P_2	12.38	12.32	13.01	12.23	13.26	12.30	13.27	13.00	13.70	13.00	12.85
Mean	12.28	12.18	13.17	12.5	13.47	12.67	13.67	13.18	13.99	13.13	11.94
SEm±	0.364		0.32		0.226		0.143		0.176		
CD (0.05)	NS		0.945		0.668		0.423		0.159		

Containers	Polymers	Chemical treatments
C_1- Cloth bag	P_1 - Polykote TM Compton	T_o - Untreated (Control)
C_2- Polythene bag (700- gauge)	P_2 - Littles Polykote. W. Yellow	T_1 - Gouch @ 6ml/kg
		T_2 - Captan + Thiram {1:1} @ 3 g /kg
		T_3 - Captan + Thiram + Gouch
		T_4 - Captan + Thiram + Gouch + Super red @ 1 ml/kg

Most of the physiological quality parameters studied declined progressively with the advancement at storage. This reduction in quality in terms of viability and vigour might be due to depletion of stored food that lead to starvation of mensitamatice tissue (Koostra & Harrington, 1973) & decline in synthetic activity at the embryo apart from death of the seeds due to fungi (Curpta *et al., 1993*). However, the seeds treated with polymer littles poly coated W yellow (P_2) had maintained better germination and vigour through out the storage when it is used either slightly in combination with pesticides and colorant (super red). The seed coated with littles polykote W yellow, captan + thiaram + gouch + super red at 1 ml/kg and stored in polythene bag (700 gauge) recorded higher germination (85.67%) as against the lowest recorded in cloth bag untreated 62% at the end of storage (table 2). The reduction in germination in cloth bag could be due to more fluctuation in seed moisture even in moisture imperious containers especially at the end of storage period might have created same and thus the germination came down. Similarly, Agarwal (1976) & Dlarma Singh (1999) also observed increase in seed moisture content and its negative association with germination in rice over storage.

Table 2. Germination (%) as influenced by containers, polymers and chemical treatments during storage in rice hybrid KRH-2

Treatment	2nd month		4th month		6th month		8th month		10th month		Mean
	C_1	C_2	C_1	C_2	C_1	C_2	C_1	C_2	C_1	C_2	
T_0P_0	83	84	80	82	75	79	70	74	62	66	75.5
T_0P_1	85.00	85.33	82.67	84.00	79.33	80.33	73.00	76.00	66.33	70.00	78.2
T_1P_1	87.00	88.67	86.00	89.00	82.00	86.00	76.33	81.33	70.33	74.67	82.13
T_2P_1	87.00	89.00	87.00	87.67	83.33	87.00	77.33	81.00	73.33	77.00	82.97
T_3P_1	89.00	91.00	88.33	88.67	84.67	87.67	82.00	82.00	77.00	80.33	85.07
T_4P_1	90.00	90.00	89.00	90.33	85.33	87.67	83.33	86.00	79.00	83.00	86.37
T_0P_2	86.00	88.33	84.33	87.00	80.33	80.00	73.67	78.33	67.00	71.00	79.6
T_1P_2	88.33	91.00	85.67	90.00	83.33	87.00	77.33	81.33	72.00	81.00	83.7
T_2P_2	90.00	90.33	86.33	89.00	83.67	87.00	80.33	82.67	76.00	82.00	84.73
T_3P_2	91.00	91.33	88.33	90.00	85.00	89.33	83.33	86.00	79.67	83.67	86.77
T_4P_2	90.67	91.67	89.33	91.00	86.00	90.33	85.00	88.00	82.00	85.67	87.97
Mean	87.91	89.15	86.09	88.06	82.54	85.58	78.33	81.51	73.15	77.67	83
SEm±	0.907		0.992		1.129		0.83		0.701		
CD (0.05)	2.59		2.84		3.23		2.36		2.01		

Containers
C_1- Cloth bag
C_2- Polythene bag (700- gauge)

Polymers
P_1 - Polykote TM Compton
P_2 - Littles Polykote. W. Yellow

Chemical treatments
T_o - Untreated (Control)
T_1 - Gouch @ 6ml/kg
T_2 - Captan + Thiram {1:1} @ 3 g /kg
T_3 - Captan + Thiram + Gouch
T_4 - Captan + Thiram + Gouch + Super red @ 1 ml/kg

The other seedling quality parameter like dry weight (9.63) was significantly higher in seeds treated with littles polykote W yellow, captan + thiram + gouch. They were stored in polythene bag as the other hand untreated, which stored in cloth bag was 4.25mg (Table 3) the vigour index another aspect related to viability found to decrease gradually in all the treatments combinations with increase in storage period. The higher vigour index (806) was also noticed in the same treatment compound to other treatment (Table 4). The polymer coating and chemical treatments keep the seed intact, as its acts as binding material; it covers the minor cracks and aberration as the seed coat thus blocking the fungal invasion. It may also acts as a physical barrier, which reduces leaching of inhibitors from seed covering and restricts oxygen movement and thus reducing the respiration of embryo thereby reducing the ageing effect on seeds (Vanangamudi *et al.* 2003). Further, the synergetic effect of both polymers and chemicals might have contributed for better germination and vigour and slow down the process of deterioration as compared to control.

Table 3. Seedling dry weight (mg) as influenced by containers, polymers and chemical treatments during storage in rice hybrid KRH-2

Treatment	2nd month		4th month		6th month		8th month		10th month		Mean
	C_1	C_2	C_1	C_2	C_1	C_2	C_1	C_2	C_1	C_2	
T_0P_0	6.65	6.72	8.67	9.40	7.00	9.32	4.87	6.12	4.25	4.50	6.75
T_0P_1	8.57	8.67	9.39	11.10	7.40	6.60	5.40	5.60	4.40	4.62	7.18
T_1P_1	7.90	7.57	12.17	13.33	9.23	8.67	7.23	7.67	6.23	6.67	8.67
T_2P_1	6.73	8.73	12.86	14.13	10.33	9.43	8.33	8.43	7.33	7.43	9.37
T_3P_1	7.07	7.90	17.48	12.07	9.33	9.23	7.33	8.23	6.33	7.23	9.22
T_4P_1	7.53	7.37	8.99	9.00	7.40	7.17	5.00	6.17	3.00	5.17	6.68
T_0P_2	8.60	8.63	11.47	10.23	4.07	12.37	4.00	9.00	3.00	8.00	7.94
T_1P_2	7.50	8.77	10.83	9.83	6.27	10.33	4.27	9.33	3.27	8.33	7.87
T_2P_2	5.03	8.60	9.49	13.00	5.53	9.63	3.53	8.63	3.00	7.63	7.41
T_3P_2	8.67	8.23	8.14	13.67	5.77	11.63	4.77	10.63	3.77	9.63	8.49
T_4P_2	9.57	8.27	9.63	11.82	5.77	9.45	4.77	8.19	3.77	7.19	7.84
Mean	7.62	8.13	10.83	11.6	7.1	9.44	5.41	8	4.4	6.95	7.29
SEm±	0.112		0.308		0.073		0.208		0.139		
CD (0.05)	0.32		0.88		0.209		0.596		0.4		

Containers
C_1- Cloth bag
C_2- Polythene bag (700- gauge)

Polymers
P_1 - Polykote TM Compton
P_2 - Littles Polykote. W. Yellow

Chemical treatments
T_o - Untreated (Control)
T_1 - Gouch @ 6ml/kg
T_2 - Captan + Thiram {1:1} @ 3 g /kg
T_3 - Captan + Thiram + Gouch
T_4 - Captan + Thiram + Gouch + Super red @ 1 ml/kg

Table 4. Seedling vigour index as influenced by containers, polymers and chemical treatments during storage in rice hybrid KRH-2

Treatment	2nd month		4th month		6th month		8th month		10th month		Mean
	C_1	C_2	C_1	C_2	C_1	C_2	C_1	C_2	C_1	C_2	
T_0P_0	552	564	694	771	525	718	341	453	264	297	517.9
T_0P_1	728	740	777	932	587	530	394	426	292	314	572
T_1P_1	687	671	1047	1187	757	745	552	624	438	498	720.6
T_2P_1	586	777	1119	1239	861	821	644	683	538	572	784
T_3P_1	629	719	1544	1070	790	809	601	675	488	581	790.6
T_4P_1	678	663	800	813	631	628	417	530	237	429	582.6
T_0P_2	739	763	968	890	327	989	295	705	201	568	644.5
T_1P_2	662	798	928	885	522	899	330	759	235	675	669.3
T_2P_2	453	777	820	1157	463	838	284	714	228	626	636
T_3P_2	789	752	719	1230	490	1039	397	914	300	806	743.6
T_4P_2	867	759	860	1075	496	854	405	721	309	616	696.2
Mean	670	725.7	934.1	1022.6	586.2	806.3	423.6	654.9	320.9	543.8	668.8
SEm±	11.285		31.316		12.932		18.672		12.542		
CD (0.05)	32.3		89.5		37.0		53.4		35.8		

Containers
C_1- Cloth bag
C_2- Polythene bag (700- gauge)

Polymers
P_1 - Polykote TM Compton
P_2 - Littles Polykote. W. Yellow

Chemical treatments
T_o - Untreated (Control)
T_1 - Gouch @ 6ml/kg
T_2 - Captan + Thiram {1:1} @ 3 g /kg
T_3 - Captan + Thiram + Gouch
T_4 - Captan + Thiram + Gouch + Super red @ 1 ml/kg

The field emergence was significantly higher in all the treatments compared to control (T_5). The polymer littles polykote W yellow + captain + thiram + gouch treated seeds that were stored in polythene bag recorded highest field emergence (80%) compared to other treatments and control (Table 5). Similarly, results were also reported by Wall (1983). Higher field emergence recorded in chemical treated seeds might be due to the protection of seeds by the chemicals and polymers against micro organition, which intern help in better establishment of seedling.

Table 5. Field emergence (%) as influenced by containers, polymers and chemical treatments during storage in rice hybrid KRH-2

Treatment	2nd month		4th month		6th month		8th month		10th month		Mean
	C_1	C_2	C_1	C_2	C_1	C_2	C_1	C_2	C_1	C_2	
T_0P_0	73	76	70	74	66	70	62	67	54	61	67.3
T_0P_1	76.33	81.00	73.00	77.67	70.33	74.33	65.33	70.00	59.00	65.00	71.2
T_1P_1	80.00	82.00	78.00	83.33	76.33	77.33	69.33	73.33	63.33	73.00	75.6
T_2P_1	82.33	84.00	79.33	85.33	77.33	80.67	72.33	76.00	69.00	74.00	78.03
T_3P_1	86.00	85.00	85.00	87.00	81.00	83.00	77.33	77.00	72.33	76.00	80.97
T_4P_1	87.33	87.00	86.33	88.33	82.00	84.33	78.33	79.00	75.00	77.00	82.47
T_0P_2	78.00	84.00	76.00	79.33	75.33	77.00	68.00	73.00	62.00	68.00	74.07
T_1P_2	81.00	86.00	79.67	83.00	77.00	78.00	70.67	75.00	68.33	70.00	76.87
T_2P_2	84.33	85.00	82.00	84.00	79.00	78.67	73.33	77.00	72.33	75.00	79.07
T_3P_2	86.67	88.00	84.33	85.00	81.00	80.00	75.33	78.33	75.00	77.00	81.07
T_4P_2	88.00	90.00	84.67	86.67	82.67	83.00	77.00	80.00	76.00	80.00	82.8
Mean	82.09	84.36	79.85	83.06	77.09	78.76	71.73	75.06	67.85	72.36	77.22
SEm±	2.511		1.322		1.121		1.125		1.423		
CD (0.05)	7.18		3.78		3.204		3.22		4.07		

Containers	Polymers	Chemical treatments
C_1- Cloth bag	P_1 - Polykote TM Compton	T_o - Untreated (Control)
C_2- Polythene bag (700- gauge)	P_2 - Littles Polykote. W. Yellow	T_1 - Gouch @ 6ml/kg
		T_2 - Captan + Thiram {1:1} @ 3 g /kg
		T_3 - Captan + Thiram + Gouch
		T_4 - Captan + Thiram + Gouch + Super red @ 1 ml/kg

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Ảnh hưởng của kỹ thuật áo hạt giống bằng hợp chất polymer tổng hợp và hóa chất đến chất lượng hạt giống và khả năng tồn trữ hạt lúa lai

Duy trì sức sống và cường lực hạt giống trong quá trình tồn trữ là mục tiêu của thí nghiệm. Nội dung nghiên cứu này được thực hiện tại Ấn Độ. Hạt giống lai vừa mới thu hoạch còn tươi được sấy khô đạt thủy phần hạt 13%. Hạt giống được xử lý bằng cách áo bên ngoài hạt bởi polymer tổng hợp là Polykote TM và Littles Polykote W Yellow. Hạt giống cũng được xử lý bằng hóa chất là Captan, Thiram, Gouch. Hạt giống được áo bằng chất dẻo tổng hợp polykote W yellow so với xử lý captan + thiaram + gouch + super red ở nồng độ 1 ml/kg hạt và được tồn trữ trong túi polythene (700 gauge) cho thấy tỷ lệ nẩy mầm rất cao (85,67%) so với nghiệm thức túi vải không được xử lý (62%) khi kết thúc tồn trữ.